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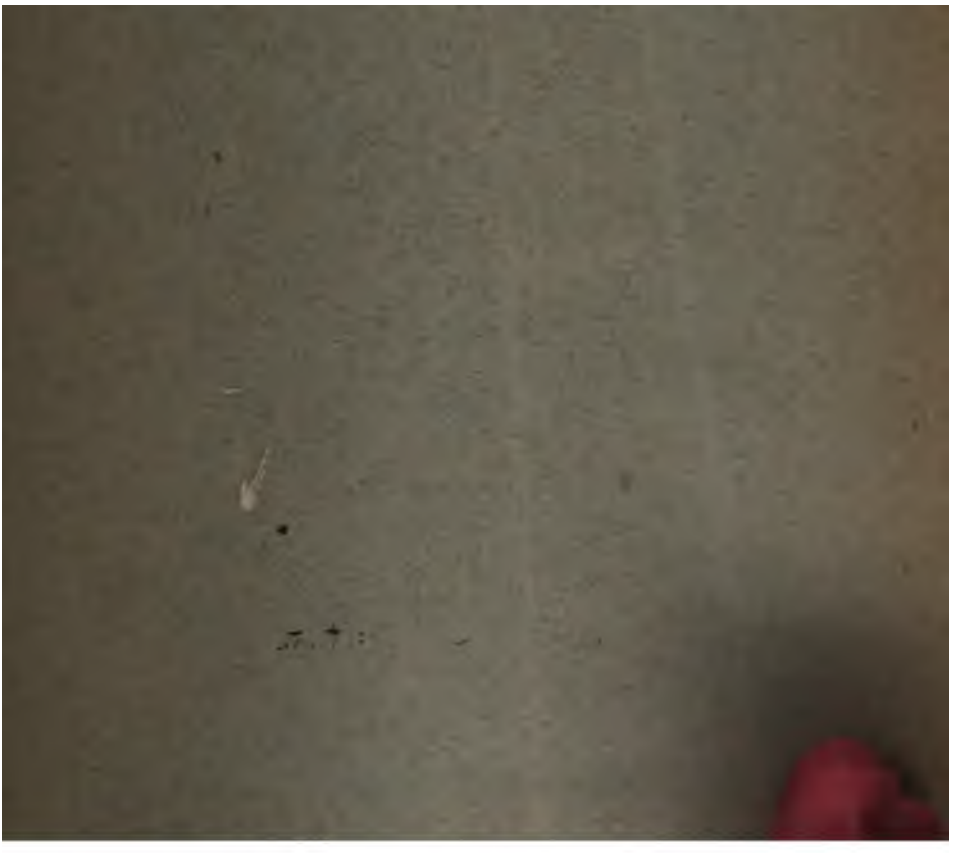

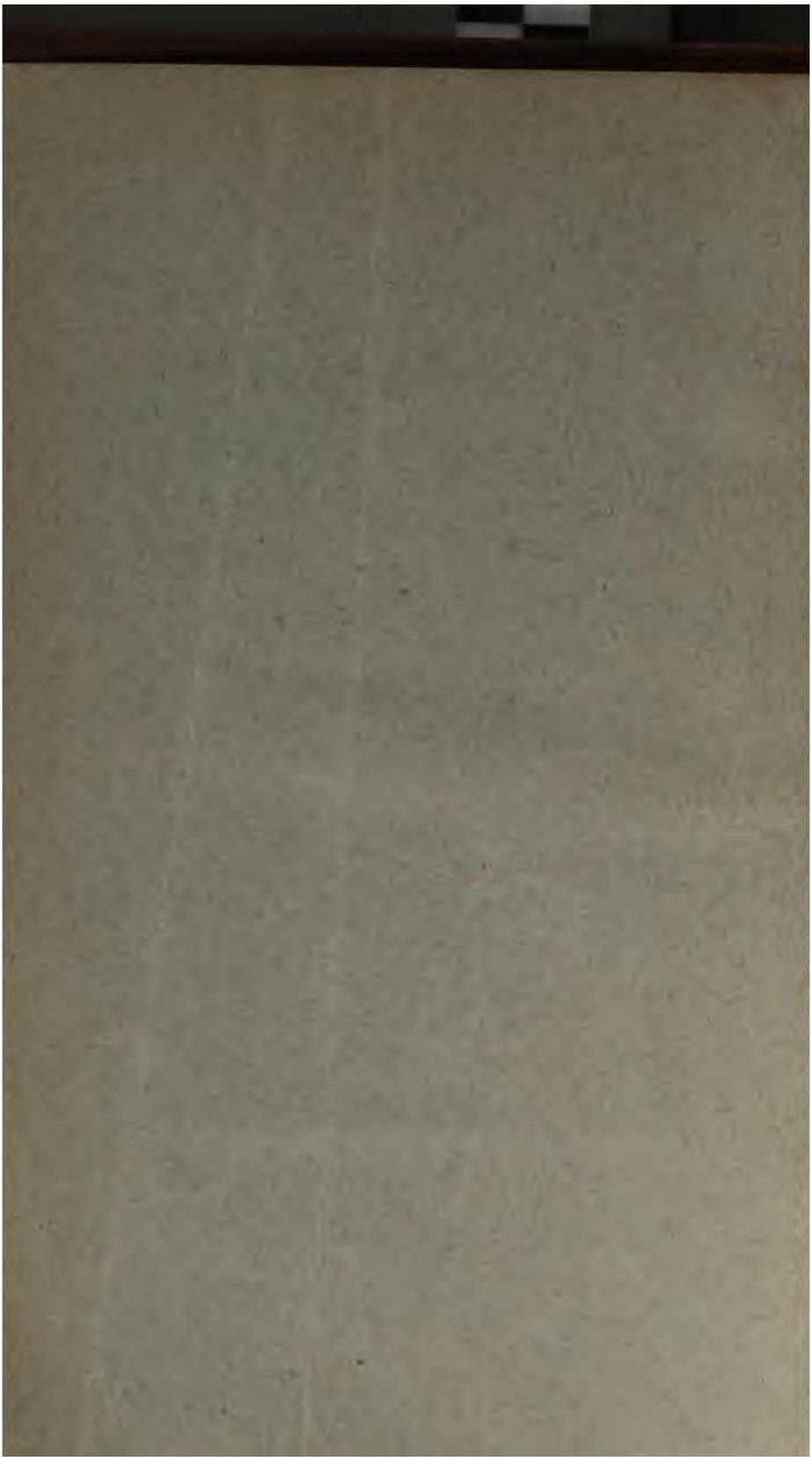

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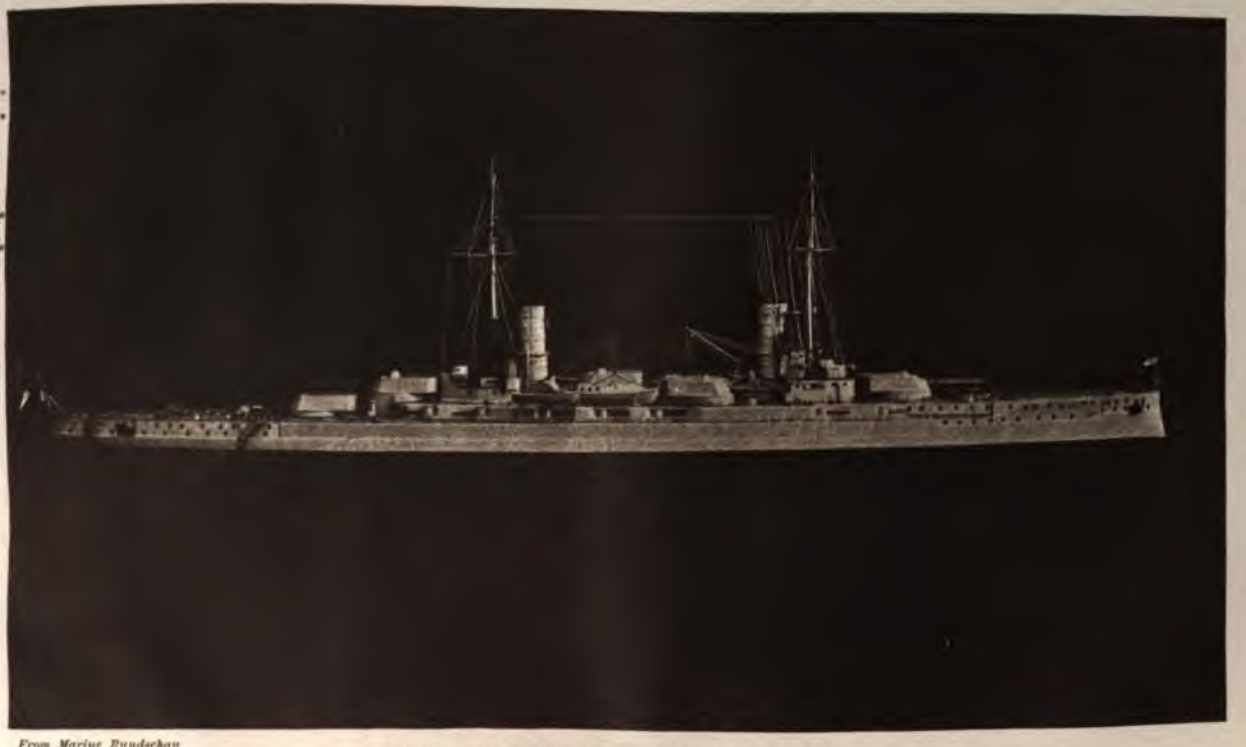

From Marine Rundschau

GERMAN BATTLESHIP, FRIEDRICH DER GROSSE.

Displacement 24,500 tons, launched March 23, 1911, to be commissioned in 1912. Armament, ten 12-inch, or ten 14-inch (authorities differ), with fourteen 6-inch guns, 21 knots speed, length 564 feet, beam 95 feet.

UNITED STATES NAVAL INSTITUTE
PROCEEDINGS.

Vol. 38, No. 1. MARCH, 1912. Whole No. 141.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PROFESSOR PHILIP ROUNSEVILLE ALGER, U. S. NAVY.

AN APPRECIATION.

Written for the Institute by

M. KNIGHT, U. S. Navy.

The Index for Volume 37 was omitted in the last number of the PROCEEDINGS. It will be forwarded with next number of th PROCEEDINGS as a folder to be inserted in No. 140.

Professor Alger, the news of his death has brou... irreparable personal loss. To them, the memory of what he wa will always far transcend the memory of what he did and the thought of what he might have done if his life had been prolonged. He had, in a most unusual degree, the gift of making and retaining friends; a gift of which the secret lay partly in his singularly gracious and winning personality and partly in the perfect confidence which he inspired as to his own unwavering loyalty to those whom he admitted to his friendship.

To the wider circle of those who, without intimate acquaintance with the man himself, were familiar with his work, his death means the loss of an uplifting and stimulating force in all the activities of the service which he loved and to which he gave

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himself without reserve through a lifetime—all too short—of fruitful and unselfish labor.

Professor Alger is sometimes thought of, by those who know him only superficially, as essentially a mathematician and a theorist. To a certain extent this view seems justified by the ease with which he dealt with abstract subjects; but any estimate of him is misleading which fails to take account of the practical side of his remarkably versatile intellect.

The son of a New England poet and mystic, he added to the imagination which was his birthright, and which was doubtless the source of the almost unerring instinct with which he went to the heart of every problem which he attacked, a practical common sense which tempered his brilliant intellectuality and kept him loyal to facts as he found them. He was not more intellectually brilliant than he was intellectually honest; and he could abandon a cherished theory which proved untenable, with a wholehearted frankness which was in perfect keeping with the other traits of his modest and generous nature. His remarkable gift for abstract reasoning he regarded always as a means to an end, never as an end in itself; and he never considered any part of his work as finished until he had drawn from it every deduction of practical usefulness which it could be made to yield.

Professor Alger was born at Boston, September 29, 1859. He graduated at the Boston Latin School in 1876, and entered the Naval Academy the same year, graduating four years later at the head of his class. His first cruise, on the *Richmond,* took him to the Pacific Station and to China. Returning in 1882, he was ordered to the Bureau of Ordnance, where he entered thus early in his career upon the path in which he was to win such marked distinction in later years.

By what seems a remarkable coincidence, in view of his extraordinary fitness to meet the demands of the situation, his entrance upon ordnance duty coincided exactly with the beginning of the "New Navy," of steel ships and built-up guns. Coming from a cruise in a wooden corvette of the Civil War period, he was called upon at once to bear a part in the design of guns built up of tempered steel, for ships as strikingly in contrast with the *Richmond* as were these guns with the cast-iron muzzle-loading

smoothbores with which that ship had fought her way past the batteries at New Orleans and Mobile Bay.

The new ships were the *Chicago, Boston, Atlanta* and *Dolphin;* cruisers it is true, and insignificant to-day, but up-to-date in their class when designed, and more heavily armed than any other ships of that day which could properly be compared with them; and, so far as ordnance was concerned, more nearly allied to the battleship of to-day than to the wooden frigates and corvettes which had preceded them.

A second tour of duty afloat, this time in the *Pensacola* on the European Station, from 1885 to 1888, was followed by another assignment to the Bureau of Ordnance, and, a year later (November, 1890), by transfer to the corps of Professors of Mathematics.

With his tenure of duty on shore assured, Professor Alger entered now upon a new phase of his career and for more than nine years was associated intimately, so far as ordnance was concerned, with every step of the remarkable advance which in that brief period carried warship design in the United States from the *Chicago* and *Boston* to the *Maine* and the *Missouri.*

In 1899 Professor Alger left the Bureau of Ordnance to take up the duties of Head of Department of Mechanics at the Naval Academy. In 1903 he was induced to accept the position of Secretary and Treasurer of the Naval Institute, a position which carried with it the editorship of the Institute's PROCEEDINGS; and the following year he resumed his connection with the Bureau of Ordnance by becoming a member of the Special Board on Naval Ordnance. This Board, created in 1904, was designed to act as an advisory board to the Bureau, in connection especially with experimental work in the development and test of ordnance material.

In spite of his connection with the Naval Institute and with the Special Board, he continued his duties at the Naval Academy until 1907, when his direct connection with the Academy was severed; and thereafter until his death he was enabled to give his uninterrupted attention to the Institute and the Special Board.

Professor Alger's career as an educator brought out in strong relief a phase of his many-sided nature which almost justifies the

conviction that here was the sphere, out of the many in which he stood pre-eminent, in which he was fitted for the widest usefulness. This was his generous and sympathetic comprehension of youth—of its promise, its trials, and its aspirations. He felt that his work was but half done when he had given to his students the best that he had to give from his wealth of knowledge and experience. He aspired to touch them at other points and to make his influence count for as much in the development of character as in that of mind. To this end he welcomed all who sought him to the refined and cultured atmosphere of his home; and many a young man found in this atmosphere, at the most impressionable period of his life, just the influence that was needed for the creation of a powerful and lasting impulse toward high ideals.

From the first, Professor Alger's administration of the affairs of the Naval Institute was brilliantly successful; and this not less on the financial than on the literary and professional sides. He rapidly enlarged its publishing department, always with excellent judgment, and added largely to its membership, especially in scientific and engineering circles. His own contributions to the PROCEEDINGS were many and notable, his "Professional Notes," being especially valuable.

The high place which admittedly belongs to the PROCEEDINGS to-day is very largely due to the energy and judgment with which he carried forward and extended the work begun by his predecessors; and those who may come after him will long benefit by the powerful and well-directed impulse which he has given to the Institute's affairs.

Professor Alger's work in Ordnance has already been referred to in general terms. To describe it in detail would call for more space than is here available. Nor is such description needed. More than of any other one man, it is true of him, that the history of the development of naval ordnance in the United States during the last quarter century is a history of his work.

He wrote much on subjects connected with Ordnance and two of his books, "Exterior Ballistics" and "The Elastic Strength of Guns," have long been recognized as standard works upon the subjects with which they deal. Another book, on "Hydromechanics," was prepared for use at the Naval Academy, and has

had a gratifying success as a text book at other institutions. He had planned, and partly outlined, before his health failed, a treatise on "Interior Ballistics," which would have been the crowning work of his career. The subject had attracted him for many years and had so far taken shape in his mind that he hoped to push it rapidly to completion when once it was seriously begun.

The failure of this plan is not the smallest of the losses to the world which are involved in his untimely death.

It is often said that no one is so important that his place cannot be filled. However true this may be, there are many who feel that it will be long before we see again combined those qualities of intellect, of character, and of spirituality, which made up the brilliant and loveable personality of Philip Rounseville Alger.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PRIZE ESSAY.

NAVAL MIGHT.

By LIEUTENANT RIDGELY HUNT, U. S. Navy.

Motto: Arms and the man.

Other things being equal, the remaining thing will always bring about the desired result. We reason thus in speaking of strategy or tactics, of fleets or ships, as well as of other affairs of life. What is this remaining thing?

If we create two battleships, or fleets, equal in every respect, it will necessitate that in a deadly conflict of one of them with the other, both must at the same moment, from the same causes, and in the same way, go to the bottom. But to create two ships perfectly equal is an impossibility; for although as mechanical structures made by hands they may be duplicates, yet before they can become useful there must be added the human components without which the creations would be utterly worthless. Here it is that the remaining thing comes into view. No matter if the men of the twin vessels be themselves twins, educated and trained together and always subjected to the same influences, yet will their two ships not be the same, for in the unseen movements of the one human mind there enter thoughts, ideas, conclusions beyond the conception or influence of the other human mind. We call this the personal equation.

As a consequence of this one unequal thing, where all other things are equal, each ship will be distinguished by her own individuality which will be reflected in the zeal, hope and confidence of the people on board her, and which will denote such a difference between the two ships as to insure that in a deadly conflict only one of them will go to the bottom. If, for example, the *Florida* and her sister ship the *Utah* were to engage one another

in battle, that one with the more competent captain and the more skilful crew would conquer; a self evident proposition which stated more simply means that the best man would win.

Most important as the determining factor in unequalling otherwise equal things will this potentiality of personality become when we consider that the combatants on the sea will be of different nationalities. In the battle that will ensue, that ship, that navy, that nation with the more enlightened men, rather than with the heavier guns, will conquer. In his work "War on the Sea,"[1] Captain Darrieus states, referring to the Russian fleet at Tsushima, that "all this available material was good for nothing without a personnel capable of bringing out its value, that these ships represented only a virtual energy, if they lacked men able to put life into them, that finally had they been ten times as numerous, the Russians would still have been beaten because they did not have to any extent the most essential of all the elements that make up military strength—moral force."

Moral force means that mental condition as regards courage, zeal, hope, confidence and the like which impels men to fight. We have read of savages armed with spears hurling themselves, until the last man expired, against troops armed with firearms; and also of trained forces engaged where one contestant entered the fray with the conviction that he would be beaten because of inadequate preparation; a condition of affairs discreditable alike to contestant and country for there is no excuse for a nation, or a military man that neglects in time of peace to prepare for war.

A war has its inception far away from the scene of actual conflict and many preparatory steps have to be taken before a naval officer can be called on to dare all that may become a man. These premonitory symptoms, however, are forewarnings of the coming of events he must be prepared to meet, contend with, and control, in opposition to the will, power, and efforts of an equally foresighted enemy. And that one of the rivals who in training, learning, spirit is the better endowed, will, if other things be equal, the better serve his country.

In our endeavor to examine very broadly and generally into the question of the predominance of the human factor as the remain-

[1] Professor Alger's translation.

ing thing when perchance other things may be equal, we shall not mention the vexing topics of rank, promotion, command; neither will the divergent views of tactics be commented on, nor the particularities of strategy—all of which have been ably set forth by talented officers, in many volumes of the PROCEEDINGS. Instead, an effort will be made to bring into notice some of the well known major elements that underlie the practice of the naval profession, and the fundamentals that inhere in the life of an officer of the navy.

STRATEGY.

First as the most comprehensive and most potent of the larger essentials of the naval life, may be mentioned strategy, a high sounding word, yet all that writers tell of naval policies and programs of naval operations and constructions, is contained in that one word, "Strategy." It is defined and its meaning is explained, in *The Century Dictionary*, as follows:

"The science of combining and employing the means which the different branches of the art of war afford, for the purpose of forming projects of operations and of directing great military movements; the art of moving troops so as to be enabled either to dispense with a battle or to deliver one with the greatest advantage and with the most decisive results; generalship.

"In strategy three things demand especial consideration:

(1) the *base of operations*, or line from which an army commences its advance upon an enemy;

(2) the *objective*, or *objective point*, the point which it aims to possess, or the object which it strives to attain;

(3) the *line of operations*, or that line which an army must pass over to attain its objective point.

"When an army assumes a strictly defensive attitude, the base of operations becomes the *line of defense*, and in a retrograde movement the line of operations becomes the *line of retreat*. *Strategical points* are the points of operation of an army—namely, points whose occupation secures an undoubted advantage to the army holding them for offensive and defensive purposes, and points which it is the chief object of an army to attain. The *theater of operations* comprises the territory to be invaded or defended by an army. It includes the *base of operations*, the *objective point* the *front of operations*, the *lines of operations*, the *lines of communication*, which connect the several lines of operation, *obstacles*, natural or artificial, *lines of retreat*, and places of refuge. The *front of operations* is the length of the line in advance of the base of operations covered or occupied by an army."

By substituting the word "navy" for "army" in the above definition and explanation of strategy, the entire object of a navy will appear—its reason for being, its work, its mission. If it execute properly the above duties of its office, it will preserve inviolate the integrity of our country as expressed in the oath of allegiance which we men of the navy charged with this God given trust take—"to support and defend the Constitution of the United States against all enemies foreign and domestic."

Setting aside as much too vast and complex for present discussion so much of strategy as is bound up with national policies, diplomatic relations and foreign affairs, let us with the *Century's* definition in mind take under hasty examination that active tangible strategy to which the navy must be committed, for which it must be always preparing and by which it must be eternally swayed—the command of the sea.

The command of the sea does not necessarily imply that a nation in order to hold title to it must have the greatest number of protected guns afloat, that is the most numerous fleets of battleships. If it did, Britannia with her two power standard would rule the wave. Maybe she does; but no first-class power is willing to grant her superiority offhand. She will have to fight for it to prove it. The command of the sea as we are now looking at it, has to do with that objective of strategy which takes cognizance of the advantages that inhere in having at some decisive point in the theater of war a fleet superior in fighting ability to that of the enemy; in other words to the strategy of concentration.

Concentration is defined as "the state of being brought from several or all directions to a common point or center or into one mass or group." Our fleet concentrates every year at Hampton Roads and Guantanamo. It concentrated at New York the other day. During the Spanish War it concentrated at Key West and at Santiago. Where, in days to come, will the center be at which our fleets shall be grouped in such manner as will warrant the assumption that we shall be in that position which will nullify the strategy of an enemy?

The answer will depend on our conception of what the nature of our situation will impel an enemy to attempt. If we are satisfied that we hold a strategic point of determining importance which the enemy, if he hope to overpower us, must himself first

west from us, we conclude that he will endeavor to concentrate his forces there. We believe we hold such a point; therefore, whether our enemy come from the east or from the west, whether his ulterior objective be the conquest of our west or our east, the immediate purpose he must accomplish before he can hope to attain any definite end and which must be the controlling idea in shaping his strategy, must be, as we view the situation, the possession of, or the mastery of, the Panama Canal. Therefore must our fleets concentrate at that common center—whether near or far is not now in question—where they can safeguard that water-way and insure that its waters shall run unvexed from sea to sea.

The Panama Canal is an artificial channel 40 miles long connecting the Atlantic with the Pacific and through it a ship 900 feet long and 38 feet draft can comfortably pass. There is no likelihood that a man-of-war of larger dimensions will ever be built, for in addition to the dimensions imposed by the locks of the canal—1000 feet by 40 feet—there are the further limits set by the depth of water in the harbors where ships must go to be docked and to obtain the sinews of war—men, provisions, ammunition, equipment and other things indispensable in enabling them to carry on unembarrassed their business of fighting. As a man goes from his home to his office and returns after his day's work is done to recuperate and prepare for the work of the next day, so does a ship go from her home or base and return to it for health and strength. And as the man selects this home with a view to its proximity to his business, the means of transportation, the safety of the neighborhood and the nearness to the markets, so does that department charged with the well-being of fleets select for bases those places where the requisites for the life of the ships can be safely and conveniently procured in abundance. Evidently the nearer these bases are to the theater of war the better, for by so much can the squadrons reach their destination in less time and with less fatigue and expenditure of energy. Therefore must the geographical as well as the material and physical location of a port be taken into consideration when settling upon a base from which a fleet can go forth in full panoply to meet the enemy. This base of operations is the first of the three things in strategy demanding especial consideration, it is the point from which the fleet commences its advance upon an enemy.

THE BASE OF OPERATIONS.

In endeavoring to select for our bases of operations those harbors in which the fleets can be best maintained for conducting aggressive warfare, the possibility of an attack on them must be given careful consideration; for unless we can safeguard our own shores so adequately that an enemy will hesitate long before daring to approach them we cannot hope to be able to lead him to conduct his operations away from our immediate coast into waters of our own choosing. It is obvious that if he can lock up our fleet in one of its bases, he holds the key, and he can attack our coast when and where he pleases; and from that moment the canal will be his. Therefore does a consideration of the question of coast defence become of much consequence and call for some amplification, though to enter into a full discussion of the matter cannot here be undertaken.

The length of the coast line of the United States requiring naval defence, as given by our Hydrographic Office, is as follows:

	Naut. miles.	
United States Atlantic Coast	3175	
" " Pacific Coast; including Alaska	7625	10,800
Dependencies:		
Porto Rico	250	
Canal extremities	20	
Hawaiian Islands	778	
Midway Island	18	
Guam	200	
Philippine Islands	8800	
Tutuila and Manua Islands (Samoa)	69	10,135
Total nautical miles		20,935
Total statute miles		24,108

Excepting Great Britain whose coast line, including possessions is 30,000 miles long, no other country has nearly so long a line as we have; for instance, Japan's is only 6600 miles and Germany's, 4100 miles. The problem of protecting the littorals of Great Britain and the United States is, therefore, more serious and complicated than that which confronts those nations that have powerful navies and short coast lines; and it would be impossible of solution as regards our country were it not for the fact that nature has come to our assistance. There are miles and miles of our coast that cannot be approached near to because of

dangerous navigation; and there are miles and miles where an approach would further no end since nothing substantial or beneficial could be gained because of lack of supplies and facilities. On the other hand there are many desirable harbors where, could an enemy land, he would find all things needful; but these places are defended.

The standard of the sea defence of a port depends solely upon the armament and armor of the fleets that may attack it. The functions which this coast defence is capable of performing are of three kinds—so informs Colonel Sydenham Clarke of the English Royal Engineers:

1. To prevent the use of a harbor by an enemy for the purpose either of shelter or of landing troops.

2. To bar a harbor or channel of approach and exclude an enemy from the inner waters.

3. To prevent the bombardment of a dockyard, town or arsenal.

"Of the above No. 2 always includes No. 1; Nos. 2 and 3 may be combined, or No. 2 may practically include No. 3; No. 3 involves denial of adjacent waters to the enemy." The question which arises in considering the above functions is that of the positions it is necessary to defend having regard to the requirements of naval strategy and the local requirements.

In order that this question shall receive the careful consideration it deserves, the littoral of the United States is divided into several districts each one of which is under the supervision of a naval officer who reports on its facilities and who should study the situation of possible landing places and lay down the probable form and strength of an attack and the best way to meet it—the kind of vessel to be employed, the suitability of submarines, torpedo craft and other coast defence means, and the number and nature of the guns needed. Some parts of the coast require more protection than others and some because of local conditions require none at all.

What may be the details of the strategy of an enemy with respect to an attack on our ports is of course unknown to us, but he would undoubtedly be influenced by his information of the limitations imposed by our preparations and situation, which must be more or less accurately known to him. An attack on summer resorts, for instance, would lead nowhere and serve no purpose; nothing of benefit in the way of supplies or position

could be gained. But a threat against a large maritime city or the spacious estuaries where our greatest commercial activities are, would work havoc. The mere contemplation of such a possibility would demand instant recognition by our fleet; and our readiness to meet such situations convincingly and to concentrate our forces advantageously, will depend largely on the strategic positions of our bases of operation—on their military characteristics, their strength of offence and of defence; and these in turn are affected by the commercial, the topographical and the hydrographical features of the environment.

Our navy owns a number of navy yards and stations scattered along our sea board, and some of them are admirably placed to serve as bases from which to begin an advance upon an enemy. Such are New York, Norfolk, San Francisco and Bremerton. There are also first order advanced bases at Guantanamo and Pearl Harbor; and there are second order bases at Charleston, Key West, Olongapo, Philadelphia and elsewhere. In addition, we have coal depots at Narragansett Bay, San Diego, Manila and other places; and besides, some other stations like Portsmouth, New London, New Orleans, Pensacola, Port Royal, Samoa, of little use to the navy because of proximity to larger and better situated bases; and of inadequate facilities and protection.

"America," the Secretary of the Navy is reported to have said, "has twice as many dock yards as Great Britain, yet the navy of the United Kingdom is twice as large as that of the United States." He showed that we had eight first-class navy yards, three second-class, two naval stations, three training stations; besides a first-class yard in Hawaii, two second-class yards in the Philippines, and naval stations at Guantanamo, San Juan, Guam, and Tutuila. "In the early days of our navy," he said, "when the ship's motive power was sail, distances were not so easily traversed as to-day, and it therefore was probably necessary to have places for repair and refit of naval vessels more frequently along our coast than to-day. We have in all eleven first- and second-class navy yards, while Great Britain has but six of the same kind. Germany has three, and France five." None the less we continue to spend large sums of money to maintain yards that cannot receive and repair modern battleships. The Secretary has accordingly recommended that some of these yards and stations be abandoned and with this recommendation

the navy is in hearty agreement. There is a consensus of opinion that we should endeavor to have concentration of effort on shore so far as it may be compatible with concentration of effort afloat.

In these days of general diffusion of news, the compositions of fleets and their prospective movements can be well guessed at from the commencement of operations. We are, therefore, in a measure forewarned; and the enemy too. And each is aware of the objective of the other, though the preliminary strategical dispositions of each may be conjectural; in this respect honors are easy. But it may be otherwise if we consider our geographical position 3000 miles from the nearest over sea power on the east and 6000 miles on the west. Here we should be able to win, other things being equal, for we hold the interior positions. There is not a point on the Atlantic or the Pacific near the probable theater of war that cannot be reached by our fleets ahead of an enemy. Add to this advantage the physical restrictions imposed at many points by the conformation of our coast, and the meager resources at other points, and the question of the bases which it is necessary to provide having regard to the requirements of naval strategy, becomes a bit simplified. These requirements are securely protected ports of unlimited capacity near the centers of great commercial activities, close by the large and commodious estuaries where are the busy cities with their railroads and piers and docks and maritime interests, and in positions commanding easily the off-shore line of defence beyond the range of the guns of the fortifications, and so centrally located that interior lines are markedly theirs. Given these and easy navigation, and our bases of operation will meet our every wish. On the Atlantic the requirements are met by the navy yards at New York and Norfolk where the largest ships can be docked, repaired, even built so complete is their plant, so convenient and abundant every necessity, so obtainable material and skilled labor. Further they are perfectly safeguarded both by nature and coast defence from attack. No other ports on the Atlantic possess these desiderata to a similar extent. It follows then that if as strategic points they are equally eminent, they must be the best bases for our fleets. Let us see.

Suppose that we conduct a line of operations from our New York base, 200 miles to the eastward to the Nantucket lightship where all the European ocean-borne traffic converges. Within a day's run, of 400 miles at 17 knots, lie Halifax on the

north and Hatteras on the south. Within two days' run, 800 miles, lie Cape Race, Newfoundland, Bermuda and Bahama. Inside this New York-Nantucket-Halifax line, lie Portland, Boston, Narragansett Bay, Long Island Sound, New York and to all intents and purposes, Delaware Bay. The "wealth of Ormuz and of Ind" is here to tempt the bold to snatch at it. But that an enemy would appear in force in these waters protected as they are by our forts and watched over by our fleets, is incredible. His coming would certainly be announced long before he could accomplish or even hope to accomplish anything worth while. At most he might feint to attack, to divert our attention from his real objective, which, we take it, will be the Panama Canal.

About 200 miles to the southward of the New York base, lies our other first order Atlantic base—Norfolk, in equipment, facilities and operation nearly equal to New York with which it is closely connected by rail and water. Norfolk serves well as a point from which to conduct a line of operations to the southward of the New York line, and to observe the movements of an enemy from the Chesapeake to the entrance to Florida Straits. The salient along this stretch is Hatteras, 120 miles southward of the capes and 540 miles from Bermuda. Within a 500 mile radius are Boston, Nassau, Florida Straits and the ports between. The Chesapeake base controls the gateway to the capital and to Baltimore, and is as near the Delaware as is New York, thereby rendering doubly secure the opulent country surrounding the two main bases.

The distance from Hatteras to Halifax is 800 miles, and that from Nantucket to Nassau but a hundred miles longer, hence a fleet based on New York and one resting on the Chesapeake ought to be able to reach either extremity of the above lines of operation in two days, at 17 knots, and effect a junction. This disposition implies the possibility of a genuine attack on our Atlantic coast in the vicinity of our most extensive resources and greatest wealth; an attack so beset with dangers that no navy, unless it had already obtained command of the sea, would risk it and attempt to push it home. But as said before he might make a false attack.

When considering the determinants of strategy, the position of bases will be found to be restricted by the natural surroundings and the material resources of the encompassing land. Where the harbors are deep and large and well fortified and the con-

veniences of a metropolis are at hand, the position is ideal; the only remaining desideratum is proximity to the theater of war. This theater will be, we fancy, the Caribbean sea, about 1600 miles from our northern bases, a four days run at 17 knots. To carry on operations affecting the integrity of the canal from nearer bases would be easier and our lines of communication would be safer; accordingly we have established a base of operations at Guantanamo in the Caribbean, 1200 miles from New York.

Guantanamo is a deep, commodious harbor near the southeastern extremity of Cuba, about 60 miles from the Windward Passage, 400 miles from the Mona and 700 miles from the Virgins —the three main entrances to the Caribbean. Guantanamo lies distant from Martinique 850 miles; from Curaçao about 600 miles; and from the canal only 700 miles, a run of a day and three-quarters at 17 knots. If a circle be drawn from Guantanamo as a center and 700 miles as a radius, we shall see that within the circumference will lie the Florida Straits, Key West, the Bahamas, the three easterly passages to the Caribbean and finally to the westward, the Yucatan Channel, the only entrance from the Caribbean to the Gulf of Mexico. From a glance at the chart it will become evident that Guantanamo is well placed to serve as a naval base and that because of its position as a coign of vantage for observation and contemplated military operations, it possesses notable strategic prominence. From its safely guarded waters, a fleet can enter upon the theater of war in a shorter time and in a better state of preparedness than can an enemy entering from over sea; and from it our fleets can go out to the north or east or south, or through the canal to the west, and arrive at any strategic point along our coast before an enemy can. Guantanamo controls the canal; therefore must we make of it an advanced base of the first order.

The natural surroundings of Guantanamo, those pertaining to the normal conditions of the land and water features of the port are admittedly excellent, but the political environment is not so because the place lies in Cuba, a foreign country whose government is not powerful or stable, whose resources are not large and whose capabilities are not high. Whether the Cubans be friendly or not, they cannot be reckoned on as a people from whom valuable assistance may be expected, for even with the best intentions they have not the means. On the other hand if

inimical they would at the least be a thorn in the flesh; and they might, if so disposed, work incalculable mischief; for we must bear in mind that Cuba has other good harbors than Guantanamo where an enemy, despite international or neutrality laws or treaty stipulations, might effect a lodgement. Therefore, from entirely different reasons than those which necessitate the safeguarding of naval bases in the United States, must Guantanamo be made impregnable to attack from the land as well as from the sea.

It may be held that serious attack from landwards, omitting that which might perhaps come from the Cubans, is out of the question, because the preservation of the integrity of the surrounding sea rests primarily with our navy. So in truth it does: and so in truth it did in 1898 when we fought against Spain. None the less at that time, the Spanish squadron entered Santiago from Curaçao 600 miles distant without our fleet being a jot the wiser. Santiago was a fortified port strong enough on the sea front to restrict the movements of our investing fleets and to protect the fugitive squadron; and on the land front to resist attack from the Cuban forces and, for a time, from our large invading army. That Santiago was an unfortunate choice of base, lacking communication with supply centers, and wanting in resources and stores for army and navy, is not so much to be pointed out now as that Santiago in itself because it afforded safety was a good base. The deduction is obvious. Guantanamo, as said in the beginning, must be expanded into a fortress of the highest rank.

About 500 miles to the westward of Guantanamo and 70 miles north of Cuba lies Key West, right in the fairway of the Florida Straits, through which passes all the sea-borne commerce of the Gulf of Mexico. This island lies 50 miles from the mainland of Florida with which it is connected by a railroad built on the rocks and shoals between. It has always held a position of prominence and importance in the naval strategy of the West Indies, and during our war with Spain became so conspicuously useful and necessary that some naval officers have thought it would be forever after quite as desirable a base. Accordingly considerable enlargement of its plant, its facilities and its capacities resulted. Similarly, though to a less extent, was Tortugas, a small island 80 miles to the westward, developed; and the line connecting the two constituted a base line of operations, the western end leading to the Gulf and the Yucatan Passage, the eastern or Key West

end to the Florida Straits and the Bahama and Caribbean passes. The unsuitableness of Tortugas because of shallow water and ease of attack has been conceded and therefore its available plant has been moved to Guantanamo. As to Key West, the answer to the strategists who advocate its advantages as the base which can best conserve our interests as they are contained in the expressions the Monroe Doctrine and the Panama Canal, is found in the words of Admiral Stockton in a discusson of Commodore Beehler's argument in favor of Key West, as follows:

"Key West is a point that cannot be ignored; every war has forced it into a position of utility and value; but the inherent defects of the place as a harbor, as almost impossible of defence, have also become evident and made known its limitations. Its position as an advanced base has been strengthened by its future railway possibilities, but the weakness of this thread of communication, the great difficulty of preserving it intact in face of an active and strong navy shows also the limitation in that direction. Year by year the place becomes less valuable as a deep water harbor and as a place where prolonged repairs can be effected with that safety from attack which is so essential in modern times."[2]

Key West, therefore, if we accept the above argument, must always be maintained because of its strategical qualities as a *point d'appui;* but not as an advanced base of the first order, because of its poor harbor, insecure communication and inadequate fortifications. A base for its own safety must be self-contained, able to hold its own without the aid of the fleet—for the fleet must be foot free—and its defences must be fixed, assisted perhaps by torpedo-boats, submarines and other auxiliaries of the mobile coast defence. If a base, instead of being able to protect ships, needs to be protected by them, it changes from a source of strength into a source of weakness. Key West, however, is the key to the Gulf and, therefore, would have to be used in case the theater of war was the West Indies, as a secondary advanced base for the less powerful, but no less necessary units of the fleet, that would be on watch off the northern entrance of the Florida Straits and off the passes of the Bahamas, all lying within a 300 mile radius of that base; and off these fairways, these lookouts would come in touch with the patrol fleet based on Guantanamo and extending its beat from that base to Nassau 400 miles northwest, and also to the Virgins 700 miles east.

[2] U. S. NAVAL INSTITUTE PROCEEDINGS, No. 130, June, 1909. Discussion of "The Navy and Coast Defence," by Commodore W. H. Beehler, U. S. N. by Rear-Admiral C. H. Stockton, U. S. N.

From the above or some similar arrangement it would come about that the three patrol squadrons—that from Hatteras, that from Guantanamo and that from Key West, would get into touch to seaward off the Bahamas, and this contact would be transmitted north by the Chesapeake lookouts, and south by the patrol fleet based on Guantanamo and keeping vigil over the many entrances to the Caribbean—except the Yucatan Channel which passage being only 200 miles to the westward of Key West, can be more easily guarded by a patrol from that base.

Another secondary base is to be found at Charleston, especially intended, however, as a home port for torpedo craft; and for this purpose it is being expanded into a fully equipped depot. Charleston has good railway connection, the harbor is deep enough and is safe, and easily safeguarded from attack, as was abundantly proved during our Civil War; and the navy yard has a fresh water front; but the depth may have to be maintained by dredging. Its position is about 600 miles from Key West, 450 miles from the Chesapeake, and 850 miles from Guantanamo. As a resting place for the smaller units of the fleet, it holds a good position; from it the little craft which have not a large coal capacity or extensive sea-keeping qualities, can hurry away in prime condition by interior lines to some other strategic point nearer the theater of action.

Charleston possesses advantages as a home port in peace times, but it seems to me that after the war is on, these torpedo-boats would better have their places of rendezvous at Guantanamo, Porto Rico and Key West, handy to the main fleet. And perhaps it might be advisable to have some of them domiciled as it were at the canal entrances where to provide a suitable base for them appears to be an easy thing to do. I venture the further suggestion in this connection, that there ought to be installed under the guns of some of the fortifications in Panama Bay a complete coaling depot, where the big ships could fill their bunkers and renew their equipment; for the distances in the Pacific are much longer than those in the Atlantic, and the ports available by deep vessels for obtaining sustenance are few and far between. Therefore it becomes a matter of serious importance to start a line of operations in this western theater of action, with a full supply of all things needful, if we would make sure of arriving at our destination in the fittest possible condition.

There are 7600 miles of coast line in the Pacific, including Alaska, that belong to the United States proper; and at only two places along this stretch can our fleet find first order bases; these are San Francisco and Bremerton. San Francisco lies 3300 miles from Panama, or an eight and one-quarter days' run at 17 knots; and Bremerton lies 800 miles to the northward of San Francisco. Besides the above bases there is a coaling station of the first order—not a navy yard—at San Diego, 450 miles south of San Francisco, and 3000 miles north of Panama—seven and one-half days at 17 knots. In the event of war in the Pacific, the ultimate object of the enemy would be, I imagine, the same as in the Atlantic, that is the control of the Panama Canal and the consequent prevention of the joining together of the eastern and western fleets. And in the western waters as in the eastern, the preliminary operations of the enemy might take place off the American coast. To grasp quickly the significance of these early demonstrations of hostility, it would be necessary of course to get into distant touch with the enemy. Accordingly from our base at Bremerton a line of observation maintained by a squadron of fast cruisers would patrol as far as Unalaska. Based on San Francisco a second observation squadron would patrol to the southward to San Diego: a third would watch from San Diego to cover the Gulf of California and the Mexican coast to Acapulco; and a fourth squadron based on Panama would guard the way between the canal and Mexico. To overlook this long stretch of coast is a most difficult task for a fleet, well nigh impossible of successful accomplishment; fortunately, however, here as in the east, it is much simplified by the physical configuration of the coast and the nature of the region behind it both of which, the former because of dangerous navigation and the latter because of barrenness, are deterrents to an attack elsewhere than in the vicinity of the large cities near which are our great navy yards and stations and stout fixed coast defences.

Furthermore, and in a most important way, is this watch and ward of the Pacific littoral made less irksome by our ownership of an outpost at the Hawaiian Islands, 2000 miles from our western mainland, where stands the second of our first order advanced bases, Pearl Harbor, a sentinel near the center of the north Pacific Ocean. Pearl Harbor is distant from Bremerton 2400 miles; from San Francisco 2100 miles; from Panama 4600 miles. From the shores of the western Pacific it lies distant from

Yokohama 3500 miles; from China 4900 miles, and from Manila about 4800 miles. It is, therefore, about one-third nearer in distance to our mainland than to the western Pacific coast. It has a splendid harbor, excellent facilities, many conveniences and can maintain a large and powerful fleet in a high state of efficiency; and it is a first order fortress. Like Guantanamo, however, it must be supplied from the mainland.

To the westward of Pearl Harbor, 1200 miles distant, lies our smallest possession, Midway Island, an American cable relay station, athwart the great circle route connecting Japan and Hawaii. An advanced squadron of observation from Pearl Harbor might make some use of the cable facilities of Midway; but otherwise the place has no military value—no ports, no facilities, no protection. Here we rest for the present further discussion of bases and lines of operation for conducting war in a theater near to our mainland, and move onward, for still westward the course of our empire holds its way, and 2300 miles from Midway and 3300 from Pearl Harbor we reach Guam 1500 miles from Manila.

Guam, while possessing a good small harbor which can be defended, lies off the beaten track, 1200 miles off the entrance of San Bernardino Straits and 1300 miles from Japan. The question of the value of Guam to the navy, as a strategic point, turns, I think on the relative advantages of the place to those to be found at Manila and Olongapo. I fail to see how Guam can be made to serve as an efficient *point d'appui* like Key West, where fleets can form and on which operations can be based; it lies near no fairway; it is further from Manila than is Japan or Hong Kong, and from San Bernardino Straits than is Formosa. On the other hand, that Guam holds a position of strategic importance has been held by many "far wiser than I."

In the Philippines we have Manila, a fortified naval port, and Olongapo with its navy and dry dock. Perhaps a single station here at a central port would suffice for all naval needs and purposes. However, the present arrangement was evolved from long discussion and much argument of the strategic possibilities and probabilities, and it will remain until some other strategic board "after mature deliberation" reaches some other conclusion. In themselves these ports are good bases of operation; they can be protected and can supply the fleet; and are in position well placed for safe-guarding the interior waters of the archipelago. But

the Philippines are a long way off from the mainland of the United States, about 6000 miles, and approximately 4000 miles from Pearl Harbor. On the other hand, from Manila to Hong Kong is only some six hundred and odd miles, and to Japan the distance is a scant 1500 miles—facts which signify that as between our mainland or Pearl Harbor or Guam we do not possess interior lines, which facts we hope to bring out more clearly later on when discussing lines of operation.

Distances are dry reading, but none the less are they in many instances the factors which enter most insistently into all the problems of strategy wherein the selection of bases, the lines of operation and the objective are the three things being especially considered; for they show that when opposing fleets are bound for the same strategic point in the theater of war, that the fleet that can concentrate first at this point with the fixed determination of gaining its objective will, other things being equal, gain a decided advantage at the very beginning of hostilities. It is evident that as regards our position in the Orient and that held by some foreign powers, we do not hold interior lines, the Philippines, therefore, stand to fall, unless of course we have a fleet there the superior in strength of that of the enemy. But we cannot take it for granted that the conquest of the Philippines would be the final objective of a power at war with our country; for so soon as that became evident our fleets would go out across the Pacific to meet him, as the Baltic fleet went out to Japan, and the struggle for the command of the China sea would be on. Which signifies that if an opponent in the waters of our possessions hopes to win a permanent victory there, he must close the Panama Canal to the passage of our eastern or Atlantic fleet.

What will be the essence of the strategy to be developed? Or, in a more general sense, what will be the objective or objective point which a navy will aim to possess, or the object which it will strive to attain?

THE OBJECTIVE.

Many of the propositions of strategy are self-evident, applicable alike to land forces and sea forces; notably so those containing such fundamental doctrines as be first in the field and the fight, concentrate a superior force against an inferior one, divide the enemy and beat him in detail, preserve unbroken contact with bases. These truisms, and many more like them, are as old as

war itself whenever and wherever it has been waged, afloat or ashore, and neither the army nor the navy can change them or disregard them. But in the practical application of these elemental precepts of active strategy as they affect the conduct of war on the sea in contradistinction to war on the land, there are several particulars in which the analogy between naval and army activities may be pushed too far. An army invades territory, holds it, defends it; a navy goes to sea, gets command of it, but can never own it, or hold it or do aught to it beyond move over it. Land is tangible, water intangible: land has ownership, positive, definite, and contains succor and shelter: the sea is free to all, contains no sustenance and the wind bloweth where it listeth; here on the sea is a fair field and no favors. In short, so far as the sea itself affects strategy, or tactics, things are equal, the same to both friend and foe. Therefore, to this extent, no more, is the navy less hampered than the army in formulating strategic plans for the attainment of its objective.

The objective of the navy, that which it should strive to attain, is, as said before, the command of the sea; and this command can be attained only by having a fleet superior to the enemy, at a certain point at a certain time and in such a state of preparedness that in the ensuing battle our opponent shall be annihilated. Where will this encounter take place? That is, where shall our fleet be concentrated? Shall it be on our own coast, or on the enemy's, or somewhere between? Near our bases or near his or out in the open? The questions may be differently put. Is the war to be a defensive one, or an offensive one, or a defensive-offensive one? If the first, it signifies that our forces will await near the protection of our home bases, the coming of the enemy whether the time of that coming be long or short. This defensive attitude must be the governing principle of the strategy adopted by a nation confessedly weak in sea power and constrained perforce to rely on winning a victory by achievements in which the land forces and the harbor defences must play a part. This kind of strategy may also be the policy accepted by a timid government and people, reluctant to imperil the safety of their ports by permitting the fleet, even though this fleet be a powerful one, to go far from the shores. Command of the sea can rarely thus be won. Instead of this stay-at-home policy, the idea should obtain that the defensive is assumed only for the sake of preparing to pass from it at the opportune moment to the offensive, when a

vigorous forcing of the issue may bring a victory. This is the essence of the strategy of the defensive-offensive that has often been resorted to by one of the parties to the fight and that has usually been attended with success.

Not infrequently a nation stronger on the sea than its adversary assumes, at the beginning of hostilities, an apparent defensive strategy because of its geographical situation, the nature of the war to be waged and the final result the government wishes to obtain. Our country awaited in and near our ports, the coming of the Spanish squadron. Similarly the Japanese awaited the coming of the Russian fleets; though both America and Japan declared the wars, were the aggressors, and held in view as their objective the destruction of the enemy's fleets in waters contiguous to their own, so that their armies might be safely landed on the enemies' soil and conduct there in security their campaigns undisturbed by the fear of being cut off from their own over-sea resources. Only by destroying the enemies' fleets, or its equivalent, can such protection be assured; and that both America and Japan would pass from the defensive to the offensive to attain this objective, fighting for it for all they were worth, was as well understood abroad as at home.

That this defensive-offensive strategy will be the naval policy of our government in the future when east is west and west is east and only the canal between and we have far distant over-sea possessions to protect, is a matter that cannot be settled off hand; everything will depend on who the enemy is. For, other things being equal, the remaining thing, victory, is more likely to perch upon the banners of that nation that carries the "war into Africa" that seeks its objective in the waters of the enemy; that is, of that nation whose strategy is founded on the principles of the offensive. Offensive strategy may be briefly explained by the statement that it signifies the moving of one's own sea frontier over against that of the enemy. Nelson frequently pursued this offensive strategy, also Admiral Farragut; and it was that of Admiral Dewey at Manila.

When engaged at war with a nearby state or when the distance separating the contestants is not beyond the radius of effective operations of a fleet depending for support on a base not remote from the theater of action, the strategy of the offensive ought certainly to be the controlling strategy of the war. But it may not be so when the road leading to the enemy is long and tedious

and beset with many uncertainties and complexities. Undoubtedly the strain of preserving intact the Russian fleet on its long voyage from Russia to Japan, so as to insure its safe arrival off Japan, impaired the efficiency of the Admiral and the personnel as well as that of the material: and the same can be said of the Spanish squadron from Spain to Santiago. To arrive at the theater of war tired, worn out both in men and material, and in this condition to give battle is to insure defeat. An offensive like this is really no offensive and the word spells only ruin. Not so was the offensive of Nelson and his fleet who could, if need be, sail from "Dan to Beersheba and back again" and fight with as much vehemence as though but yesterday from port.

A fleet on the offensive when the war is to be carried on over against the coast of an opponent, has at its command for attaining its ends four methods which our Admiral Sampson in discussing the coast defence of the United States stated, may be conveniently divided as follows: Attack on commerce: Blockade: Bombardment: Invasion.

The method of attaining the objective by an attack on the sea-borne commerce of an enemy has an attractive appearance because it employs that kind of strategy which rests on the supposition that much injury can be inflicted on the carrying trade on which a nation depends for sustenance, without at the same time endangering the safety of the fleet intrusted with the destruction of this sea-borne commerce. An attack on commerce necessitates the posting of a considerable force near the entrances to those narrow water-ways and restricted seas towards which lines of sea traffic converge, and to intercept there the stately ships as they are going on to their havens under the hill. Conceivably for a time such a stoppage of the commerce of Great Britain might prove annoying to her, but that it could last long enough to cause much scarcity of food is not thought possible though there might be some diversion of trade and some derangement of business; for sooner or later an English fleet would be out on the sea not only to convoy her merchant ships but also to bring to book the molesters of her trade.

An attack on commerce implies a defence of commerce. Two merchant flags out flaunt all others on the sea to-day—the English and the German. England is building battleship-cruisers of 28,000 tons, mounting 12- and 13½-inch guns, carrying fuel to steam to the uttermost part of the world, and speeding at the rate

of 26 to 28 knots—a knot or two faster than her own swiftest Atlantic greyhounds. Germany is following suit but has not yet equalled in numbers, size and power the English construction; and Japan is about to enter the lists. The building programs of other nations do not lead to the belief that the battleship cruiser is a favorite type, even with those powers who, in other days, were the exponents of that strategy known as *guerre de course*.

A war of chase has in times past had much influence in determining the naval strategy of France; and in some of its aspects it does appear commendable, as when a nation owns many remote dependencies and colonies with which it carries on an extensive trade. But to seek and not to find is of daily occurrence on the sea and blockades have always been run. However, in any naval war, commerce must suffer from those causes which are common to war itself and which cannot be escaped from by friend or foe. Such are increased cost of maintenance, expensive insurance, higher wages, fewer seamen; also the stoppage of commercial activities connected with maritime trade, and the chartering of vessels to the navy. All these disturbances disorganize and proscribe the business of the sea, and therefore it comes about that when peace returns the old order will be changed.

Our merchant marine never revived after the Civil War because the opening of the west by the railroads gave opportunity to men to earn a more natural and agreeable living on shore than a life on the ocean wave. This is the situation now, and although it does not perhaps pertain to strategy, yet is it important; even had we the merchant fleet we have not the men to man it. The point to be noticed here, however, is not the scarcity of seamen, but that in the constitution of our navy to-day, a war against commerce is not taken into account as a probable objective. "In so far as this [a war of chase] is one means to a general end," writes Mahan in "Sea Power," "and is based on a navy otherwise powerful, it is well. . . . It is not the taking of indvidual ships or convoys . . . that strikes down the money power of a nation; it is the possession of that overbearing power on the sea which drives the enemy's flag from it."

Blockade is defined as "the shutting up of a place, particularly a port, harbor, or line of coast, by hostile ships, so as to stop all ingress or egress and to hinder the entrance of provisions, ammunition or reinforcements."* Blockade partakes of the nature of

**The Century Dictionary.*

commerce destroying, differing from it only in particulars; in the one case the fleet goes forth in search of commerce, in the other the fleet, practically at a standstill awaits its coming. Blockade under favorable conditions becomes a very effective objective depending, however, for its successful accomplishment on the improbability of a derangement of its plans of operation postulated on the two certainties that the enemy has not a fleet of sufficient strength to drive the blockaders off and that he depends on extraneous means for his subsistence. The most notable example of a successful recourse to the blockade as the objective of strategy is found in the shutting up of the ports of the confederacy during our Civil War. During the Spanish War Cuba was blockaded, but in this instance the aim seems to have been to shut in or out warships rather than merchant ships, though the latter were of course as carefully excluded as possible.

"The object of a blockade," wrote Admiral Sampson nearly ten years before he himself was called on to assume the responsibility of instituting and maintaining one, "may be to close a port that contains an important dockyard and prevent access to it by your own ships; or it may be to confine within the port our own armed vessels that may have assembled there; or it may be for the purpose of interrupting and destroying the commerce of the port." Of the last purpose we have already expressed an opinion. Excepting in rare instances it can be reckoned only as a means, not an end. Of the first object given above, to close an important dockyard and prevent access to it, it can also be said that perhaps it purports to be a means rather than an end, though here the aim to debar an enemy from returning to the support of his own bases and to destroy his efficiency by closing his own ports to him is one that an assailant of preponderating force might undertake if he wish to conserve his strength and expend but little of his energy, and is, furthermore, sure of the movements of his opponent. For example, a fleet might be coaxed away from its base by some ruse, or it might be away looking for its enemy, who in the meantime has slipped in off the harbor to which the other fleet is obliged to return. Something of this kind might have happened as the result of the Russian sorties from Port Arthur and Vladivostok, for the Japanese had additional superior fleets on watch off Tsushima. Unless the blockading fleet is much stronger than the fleet it seeks to exclude, the latter will force the fighting

and drive the former to within the range of the shore batteries and thus place it between two fires.

A blockade to keep an enemy outside his own ports and prevent his entering is the opposite of a blockade to keep him inside and prevent his leaving which is the second objective of a blockade mentioned above. Bearing in mind that the admiral was writing of the coast defence of the United States, we again quote his words: "A blockade . . . may be to confine within the port our own armed vessels that have assembled there." This is precisely the problem solved by the admiral at Santiago, except that the imaginary situation was reversed in the real—it was to confine within the port the enemy's armed vessels that had assembled there. In the harbor of Santiago the Spanish squadron was blockaded by a vastly superior American fleet well found in all those military respects in which the Spanish fleet was wofully lacking. Necessarily the strategy of the campaign was a success; our troops were landed; the Spanish squadron was destroyed, and Cuba fell. Blockading did it, and nothing else. Blockading was likewise employed by the Japanese and for the same purpose as by the Americans—to confine the enemy's fleet in port while the army was being landed; that is, blockade was adopted for the purpose of securing the uninterrupted movement of land forces—for invasion. Both the Japanese and the American blockades might have been forced by a fleet with the stomach to fight. In a sortie from Port Arthur the Russians out manœuvered the Japanese and had the game in their own hands but lost all the tricks; and the last of Cervera's ships fell only after a stern chase of 50 miles.

A difference is to be noticed between the arrangements made by the Americans and the Japanese for maintaining the effectiveness of their blockades. In the former the investment was by the entire fleet—battleships, cruisers, torpedo-boats, converted yachts, disposed in a cordon in full sight of the shore batteries of the enemy: near by was a base at Guantanamo, to which the ships repaired one at a time for equipment. In the latter the Japanese fleet was based on the Elliott Islands 60 miles distant from Port Arthur and off them the major units were concentrated, screened by a fleet of torpedo craft and cruisers stationed off the harbor entrance where the blockade ships could plainly see them. In the method adopted by the Americans the permanent shutting up of the enemy in his own port, emphasized by the sinking of the

Merrimac, was the objective of the blockade. In the method adopted by the Japanese the exit of the Russians was apparently looked for and they could then have been finally disposed of on the sea. The attempt at blockading the harbor of Port Arthur by sinking ships at the entrance was not made until later in the war when the Baltic fleet was en route.

The plans of both America and Japan for sealing a harbor with sunken ships miscarried—perhaps they always will: circumstances, however, govern cases. The procedure of the American fleet was the best possible to achieve the naval purpose of the campaign—the complete paralysis of the Spanish forces by a visible exhibition of preponderating naval power; for the two military arms of the two belligerents, the navy and the army of the United States and the navy and the army of Spain, were conterminous. This was not the situation that confronted the Japanese at the outset of hostilities; their army was landed on a neutral soil far away from Port Arthur and at a time when there could be no conjunction of the army and navy of either contestant. To conduct a blockade so that the blockaded will be encouraged to force it and appear in the open and there be met and fought to a finish was the strategy of Nelson, whose one idea when near the French fleet was to get at it and destroy it; for so long as it remained intact in port it was more or less of a menace and necessitated the presence of a fleet whose services might be needed elsewhere.

Bombardment as an objective of a navy is permissible when the demoralization of a people is desired and the demolition of defences is demanded to strike such terror in a government as will compel it to yield. Against defenseless towns bombardment is regarded as unnecessary, cruel, inhuman, but against defended ports, especially those protected by sea fortifications, it has frequently been resorted to to destroy their military efficiency and render them unfit and unsafe for occupancy by the native fleet that might hope to use them as bases. As a side issue perhaps, bombardment might be resorted to as ancillary to some other objective like blockade or invasion; a fleet, en route, might strike at a line of fixed communication or a poorly guarded station or depot, to cripple its equipment. Again, bombardment might be used to compel a squadron seeking safety under the guns of the land, to show itself; the American fleet bombarded San Juan with this object. In the above instances, and in many similar

ones, the attack of the fleet on the land is not made with the intention of permanently occupying the land or reducing its defences so that an army can be put ashore, for such a final objective of bombardment can only follow after the power of the enemy's fleet has been nullified. But a town might be bombarded even when it offers no visible defence, if under the consternation and fear incited by falling shots, an army might be quietly landed. And further bombardment might be employed as a threat to force compliance with a demand for indemnity: also as a punitive measure. In these instances, where unfortified places are to be attacked, notice of bombardment ought to be given if possible, so that the inhabitants may move away out of danger.

The expediency of resorting to bombardment as a method of subjugation is doubtful, for the expenditure of ammunition is incommensurate with the damage done. Generally the threat is quite as efficacious as the execution. At Manila after the destruction of the Spanish fleet, the town remained quiescent under the guns of Dewey's ships. Elsewhere during the Spanish War nothing worth the telling was accomplished by bombardment. At Matanzas, Cabañas, San Juan, even at Santiago, no damage was done to the fortifications and nothing was gained by the fleet. But we must not, therefore, conclude that bombardment is not a good strategic method of attaining an objective. Under cover of bombardment Farragut ran the forts at Mobile, New Orleans, Vicksburg. And Italy landed her forces at Tripoli. But in these operations and in nearly all others like them, the navy has usually had as the distinct objective of bombardments the clearing the way for the untroubled landing of the army; that is, for invasion.

If by the word invasion we understand it to mean "the ability to invade, to make a landing safely in an enemy's country," then is invasion the elemental concept of all military strategy; for if you find that your opponent's coasts are unprotected, his commerce unguarded, his harbors unlocked and all such things at the mercy of your guns, it must be obvious that his fleets no longer exist and that his fate lies in your hands to do with him as you please. To be in a position to make a landing safely in an enemy's country, the road leading to that country must first be cleared of possible obstructions and then kept clear. To secure this right of way beyond the shadow of a doubt, your enemy's sea power must be reduced to impotency and his defences at the

ports of debarkation must be silenced. These offensive measures having been successfully carried out by the navy, the army can be transported to the enemy's country, landed safely, and the further prosecution of the war be entrusted to the land forces; for with the actual putting of one's foot on shore and invading his territory by marching over it and fighting for its possession, the navy has nothing to do.

There have been many occasions on which fleets and single ships have landed their naval brigades as artillery and infantry, and invaded foreign territory as, for instance, at Sumatra, China, the West Indies, and at several Central American and other ports. But these invasions were not made for the purpose of capturing property; they were made for the purpose of protecting American interests from the predatory hands of revolutionists; they were forceful threats of what might follow from a disregard of the rights of neutrals; and upon the restoration of order, the brigades have returned quietly to their ships. Such operations the navy is constantly undertaking in countries with which we are in no sense at war; and are not analogous to the bellicose movements with which strategy is concerned, but are made with the connivance of a government to assist its efforts to preserve order. The invasion contemplated by strategy is the ability to occupy or control the soil of a foreign power in opposition to that power's efforts to prevent it. After this opposition has been overcome by the navy, the actual holding of the land devolves upon the army brought there by the navy.

A blockade if it can succeed in confining irreversibly an enemy's fleet within a port may be resorted to as a means of protecting the landing of troops; and bombardment, too, may be, as it often has been, effectively employed for the same purpose. From which it might be deduced that the objective of naval strategy might perhaps be blockade or bombardment as it was in our Civil War. Not so, however, for in that war there was no fleet or semblance of one in opposition. In recent wars both blockade and bombardment were resorted to only as a means to attain the real strategic end which was invasion in the face of naval opposition. And although this end was attained for all purposes before the destruction of the enemy's fleet, yet was it not in reality an uncontrovertible fact until after that fleet had been destroyed. The objective, therefore, whether it be sought by means of commerce destroying, blockade, bombardment or invasion, is in the last

analysis the destruction of the enemy's fleet; and this destruction should follow as the result of the successful conduct of a line of operations, that third thing in strategy demanding especial consideration.

THE LINE OF OPERATIONS.

In time of peace we prepare for war. In the security of our offices we engage in mimic warfare; we place an enemy now here now there, and conduct imaginary operations against him using known quantities like his strength in ships, the location of his bases, his military resources; and the unknown ones like his base of operations, his line of operations, his objective. Hence follow two kinds of strategy—the theoretical and the practical. The former selects bases, studies situations, arranges programs, anticipating coming events; the latter unfolds as the strategy of the enemy becomes apparent, and is altered from time to time to conform to the needs of the occasion. But the known factors cannot be eliminated from the active war problem for the latter depends for solution on the fixed principles of the science of strategy which determine unalterably what means shall be always at hand for putting into practical effect this or that line of operations.

The line of operations is that line over which a fleet must pass to effect concentration; and since it is liable to attack, great care must be taken not to be led astray from the straight path leading to that end. There must be a rigorous holding to the specific object in view—to reach the enemy in the quickest time and in the best position to fight him. Nelson led his fleet from the Mediterranean to the West Indies and back again in search of the French fleet: there was no dalliance with other interests, no running after false gods, his one objective was his enemy's fleet. And although he operated on unusually long lines yet he arrived at the front of operations "fit for a frolic or a fight." There is no need to state that if a line of operations is so long and hazardous as to cause exhaustion by the time the front of operations is reached, it serves no good purpose.

The line of operations is the possible fighting line, the front of operations is the actual fighting line. It may happen that the line of operations and the front of operations run parallel or coincide, they often do; and they can never be divorced in considering naval strategic movements. The front of operations may

be defined as the length of the line covered or occupied by the fleet after the enemy has been located. It signifies the final strategic disposition of the fleet before it enters upon the domain of tactics. The strategy of the front of operations like that of the line of operations falls under the purview of the strategic board, but the execution of the plans even to the extent of changing them must be largely entrusted to the judgment of the commander of the fleet, who, being so much nearer the scene of operations, can with a clearer eye more fully discern the advisability of pursuing this or that plan of action. He knows best the efficiency of the units of his squadrons, what ships have foul bottoms, or defective machinery or insufficient equipment or sick crews. And he can often foresee movements of the enemy which from their nature cannot be known to the strategic board. It should be recognized that in a large measure he has forced upon him by circumstances the responsibility of the active conduct of the war; and, therefore, when he brings his fleet to the front of operations he should be permitted to regulate matters to suit himself so long as they may be in consonance with the general plan of the campaign "so true is it that one man and one intellect properly qualified for a particular undertaking is a host in itself," as was said of Archimedes at the defence of Syracuse.

The front of operations cannot be carried beyond half the steaming distance of the least efficient vessel of a fleet. That is, if this vessel because of excessive fuel consumption or weak boilers or poor coal, has a radius of only 4000 miles, her effective power as a fighting ship would limit the front of operations of the whole fleet to a range of half this distance or 2000 miles, even if the other ships could go twice this distance. Steaming efficiency is an element of great importance in preparing strategic plans for conducting war in the waters of distant possessions. Dewey's line and front of operations led him into Manila Bay where with his tactics he gained his objective, the destruction of the Spanish fleet. Further operations he could not engage in because his nearest base was beyond the reach of some of the units of his fleet. That having utterly ruined Spain's sea power in the Orient, he had attained his objective and there was, therefore, no other line of operations for his fleet, is not to be pointed out in this connection; but that he was virtually tied to Manila until assistance reached him. Here becomes apparent the value

of Pearl Harbor as a strategic point on which to base a line of operations in the Pacific.

In the event of war in the Philippines the line of operations would extend across the northern entrance to the China Sea and connect to seaward off Cape Engaño with a line stretching up from San Bernardino Straits. Maybe this line of operations might have to be triangular—from the straits to Guam to Cape Engaño. But unless our fleet be very strong relatively to the enemy's, Guam might as well be left to itself. I think the front of operations would be off the west coast of Luzon, Manila being the objective, and the proceedings quite like Admiral Dewey's, his way being the shortest, safest and easiest. Manila fallen, the victor might perhaps pass on out through San Bernardino Straits, stop for a moment at Guam and then proceed at slow speed across the Pacific towards Panama.

Here again Pearl Harbor rises like a tower of strength near the center of this trans-Pacific route. If he can pass by without being badly damaged, well and good, he stands a chance to reach the canal. This movement across the Pacific presupposes the destruction of our Philippine fleet, a not altogether unthinkable catastrophe; for interior lines as pointed out elsewhere are held by the English, Chinese and Japanese, and neither one of them would be so foolhardy as to conduct a line of operations in distant waters while a powerful fleet in being remained in his rear. But to make us sure of holding the Philippines our fleet there would have to be much strengthened; and to do this might necessitate the weakening of our force elsewhere at a time that might be inconvenient for consummating the designs of the campaign. However, the Philippines are ours for better for worse, and must therefore be safeguarded. That they will be a cause of constant anxiety from a naval strategic point of view whensoever, wheresoever and with whomsoever we may go to war, we cannot prevent.

In respect to our American coast, Pearl Harbor stands on the outer line of defence. Were an enemy to get inside it, he would be between two fires, for from our mainland bases and from Hawaii we could reach him by short lines of operation. If Panama be the objective, we shall have to extend our lines, and of course, the enemy will have to lengthen his: but Pearl Harbor is only 4600 miles from the canal while Japan is 8000 miles; we, therefore, in the race have a double advantage over him; and

when we recall that we have a fleet awaiting him in the Caribbean we find we have him here also between two fires.

Before quitting the Pacific lines of operation, a few words must be submitted concerning our far removed unfortified possessions in Samoa-Tutuila and Manua Islands. They lie in the south Pacific distant about 4500 miles from the Philippines and the Japanese shores; some 3100 miles from Guam; about 2300 miles south of Pearl Harbor; and nearly 6000 miles from Panama. Close alongside them and in the same group are two other islands that belong to Germany. Samoa has no natural facilities for assembling a fleet and no material resources for assisting one; excepting coal our fleet could not be provided with anything. I, therefore, venture the suggestion that these Samoan possessions of ours possess little strategic value. What with out Pacific mainland, our Hawaiian Islands, our Philippine group, our Panama Bay, to say nothing of Guam and northwest Alaska, our hands are pretty full without the addition of Samoa. If we look at the chart we shall see that if we sought to protect it adequately we would be jeopardizing the safety and welfare of our other possessions and shores that are much nearer and dearer.

In connection with what has been said above and also with some remarks submitted under the "Front of Operations," is the implication that a fleet is limited in its ability to concentrate at a distant theater of war by the circumference of a circle described from a base as a center and with a radius equal to half the full steaming distance of the least efficient unit of the fleet. This inference needs to be somewhat qualified, for while it holds in the abstract it does not always in the concrete. For instance, the *Oregon* and the *Marietta* from the Pacific, reached the front of operations in the Caribbean by coaling en route at neutral ports: the Russian Baltic fleet made as long a voyage under much more trying circumstances, and was able to reach the front of operations with so much coal on board that the armor belts of some of the ships were submerged. On the other hand, the Spanish squadron arrived at Santiago with bunkers empty, having been unable to fill them at Martinique or Curaçao, a condition of exhaustion, however, which may be attributed to the remissness of the Spanish home authorities in failing to make proper arrangements for supplying fuel and other requisites of efficiency: consequently was the mobility of the squadron so impaired that the

ships had to seek the most convenient harbor at hand, and remain there impounded.

To provide against such impotency and to permit of the extension of a line of operations, fleets have to-day as essential parts of their organization, a number of auxiliary non-combatant vessels such as colliers, repair ships, tank vessels, and others to accompany the fighting force on its voyage and supply it with all the things it may need. We must bear in mind, however, that an auxiliary can only accompany the fleet for a distance equal to half her full steaming radius—unless she be towed—for she must retain enough fuel to insure her easy and safe return to her own base. Again, the speed of the auxiliary is that of the slowest ship; and again, coaling ship at sea is slow work and delays the movements of the fleet. Auxiliaries are necessary; fleets to-day cannot maintain their position without them; yet they may be harmful, for if the fleet be attacked while encumbered with them, they may have to be protected. Auxiliaries were taken to the front of operations at Tsushima. In this particular instance their presence did not, perhaps, have any effect on the result, but undoubtedly the tactical formation of the Russian fleet as it came up to the front had their protection in view. Whenever circumstances permit it to be done, a fleet making passage ought to resort to its auxiliaries to fill every need, supply every want, satisfy every desire. Then, freed of its impediments, it ought to be ready and anxious to meet its opponent, so that only the brain of man shall stand between it and victory. Whereabouts will this final encounter take place? In other words where, when all other things are supposedly equal, will the remaining thing, the battle of the wits be engaged in?

THE THEATER OF OPERATIONS.

Many years before the building of the Panama Canal was begun, Admiral Mahan wrote in "Sea Power" somewhat as follows: "If the canal be made, the Caribbean will be changed from a terminus and a place of local traffic into one of the great highways of the world. Along this path a great commerce will travel, bringing the interests of other great nations, the European nations, close along our shores, as they have never been before. With this it will not be so easy as heretofore to stand aloof from international complications. The position of the United States with reference to this route will resemble that of England to the

Channel and of the Mediterranean to the Suez route. As regards influence and control over it, depending upon geographical position, it is of course plain that the center of the national power, the permanent base, is much nearer than that of other great nations. The positions now or hereafter occupied by them on island or mainland, however strong, will be but outposts of their power." Long after this was written and long before the site of the canal had been selected, the United States engaged in a war against Spain in which the Caribbean was the theater of operations and in which the positions of the contending powers and the situation in general, reviewed as a whole, were not dissimilar to those forecasted by Mahan, nor unlike those which the future may reasonably be expected to bring forth, but in a more marked and emphatic manner. It seems well, therefore, to look once again and this time more carefully than before, at this stage whereon we are destined to play a great part.

The Caribbean Sea has been thus described: "This grandest inlet of the western hemisphere—corresponding in several respects to the Mediterranean—is separated from the Gulf of Mexico by Yucatan, and from the Atlantic Ocean by the great arch of the Antilles, between Cuba and Trinidad inclusive, stretching in north latitude from about 8° to about 22°, and in west longitude from about 61° to about 89°."[4] In that both Mediterranean and Caribbean lead to great canals through which enormous volumes of commerce must pass and that both have been and probably will again be the theaters of war, the likeness between the two is evident. The dissimilarity between them lies in the important fact that the Mediterranean can be entered by but a single natural gateway, the Straits of Gibraltar, whereas the Caribbean is connected with the adjacent ocean by many passes through which deep draft ships can safely steer. One powerful state, Great Britain, holds the fairway into the Mediterranean under her guns at Gibraltar that synonym of strength, whereas several states, some of the first rank, hold the command of the different passes into the Caribbean.

The stones of which the great arch of the Antilles is built belong to divers nations. Great Britain owns thirteen or more; among the most important, Jamaica, Barbados, and St. Lucia. France possesses Guadaloupe, Martinique and others. The

[4] Encyclopedia.

Dutch occupy the Curaçaos—though since they lie in the southern part of the sea well inside the other stones, they perhaps do not form a component part of the arch. Denmark holds title to the Virgins at the northeast bend of the arch. Over against them lies our Porto Rican territory. Next is Haiti and San Domingo, an independent island belonging to two colored republics; and next comes Cuba, also independent, but really under the suzerainty of the United States. This completes the great arch that separates the sea from the ocean. On the south the boundaries of this grandest inlet of the western hemisphere are Venezuela and Colombia. Then comes Panama with its territory cut in two by a ten mile wide ribbon of land of American ownership through the center of which runs the thread of the great canal. Next along this western littoral comes Central America, topped off by the conspicuous Mexican promontory of Yucatan.

Distinguished because of the absence of any national foothold along the shores of this Caribbean Sea, is that mighty, forward, warlike state Germany; crowded at home, needing an outlet abroad and desirous of securing one. Many Germans are to-day domiciled in Central and South America and in the Antilles, and are carrying on unobtrusively a lucrative and expanding business. All of which state of affairs are significant facts to be taken into consideration in shaping national policies and formulating military programs.

When selecting strategic points the occupancy of which will be of advantage to the nation holding them for conducting warlike operations, both the ethnographic and geographic features of the surroundings must receive due consideration. It is manifestly less annoying to have near our fixed positions, a weak and insignificant people with whom war would be impossible, than to have as neighbors a strong, aggressive nation with whom we might possibly be at sword's point. Nearest our Caribbean base, Guantanamo, are the Haitians on the east, and the English in Jamaica on the south. Nearest the canal, of the great states is still England in Jamaica. At Porto Rico near the salient of the arch of the Antilles we have Denmark on the right and Haiti on the left. Over along the other sea-boards sit nations whose navies have not been at all developed and whose forces for operating in the Yucatan Passage and about the canal are negligible.

In the above roughly sketched outlines of the Caribbean theater of operations and its environment we have, as it were before us, the scenery and the setting of the stage and the entrances and exits through which the actors can come on and go off as they play their several parts. The theater is a large one, but not large enough for two rival troops to hold the boards at one and the same time: a fight must result from any such attempt; and either the one company or the other must be left in undisputed possession. Stating this cold fact less dramatically, we may say that the "theater of operations comprises the territory to be invaded or defended by an enemy."

Pertaining to the theater of war and the three especial things of strategy we have been considering, are several other things; notably the lines of communication which bind together into an harmonious whole all parts afloat and ashore—the strategy board, the fleet, the government, so that there shall be that coördination of efforts which will make for an intelligent conduct of the campaign. Despatch and supply vessels must be free to come and go between fleet and base, and cable and wireless telegraphs must be secure from interruption. The wireless is the most important means of quick communication thus far developed, and it was successfully used by the Japanese; but the Russians could have stopped it had they known how: perhaps in the future the system will be improved so that messages can pass without fear of disturbance. Also in the future may come the wireless telephone; and near at hand is the aeroplane. It can move with great rapidity—60 or 70 miles the hour. Of the value of the aviator as a scout I am skeptical. He can be seen as far as he can see and be shot at by other fliers, and by guns and small arms. As a messenger he may also become a target, but he will then be on the inside lines under the protection of his own fleet. If, however, the aeroplane is to be developed into an efficient offensive weapon, then I take it, flier will meet flier and the battle in the clouds might be magnificent but it would not be war. Of course, if only one belligerent have flying machines, the advantages to him may under some conditions be very great—the Italians used them effectively against the Turks—but as a rule as soon as one navy adopts a means of offence or defence every other navy hastens to provide similar means; the only unchanging but always differing element common alike to all navies, is the human element.

Also pertaining to the theater of war though less important than lines of communication, is the proximity of harbors of refuge to which ships might retreat for shelter and protection because of some accident. Many such ports are found in the West Indies but, excepting one, they are not located uncomfortably near our own great base Guantanamo. That one exception is Jamaica, 100 miles south of, and opposite to Guantanamo and our main water-way between the canal and home base—the Windward Passage. Nature has here, however, as at Bermuda, Nassau, St. Lucia with its frowning heights, and at all other West Indian ports, interposed in the matter of distance from home, area, depth and protection. If Jamaica could be made a first order base it, and not Guantanamo, would be the key to the canal; but Jamaica lies 4000 miles from England.

In days of old when warriors bold commanded sailing ships mounting smooth-bore guns, there were no such restrictions imposed by size of ship and power of gun on depth of channel and protection of port as are to-day imposed by drafts of 28 feet and guns of 14 inches. The old hearts of oak were at the mercy of wind and wave and when the elements were unkind the port of refuge was sought. To-day we steam into or out of port because we want to, weather has nothing to do with it. Further, to-day we know approximately the speed of our enemy and we know with certainty our own. Therefore can we compute our distances with that factor best known which in the days of sails was least known. We take no thought of meteorology, it was the breath in the nostrils of Nelson. Hence we are not dependent for safety and sustenance on the number and proximity of our harbors, but on their position as it may affect our facility for conducting conveniently and expeditiously the lines of operation. In the Caribbean we have our base and Porto Rico; we have also the run through the Yucatan Channel to the Gulf ports; and we have the canal.

Shall we prepare strategic plans based on the supposition that the Panama Canal will be the objective and that therefore the theater of war will be near our shores?

For generations our people have believed that our integrity as a nation depended upon efficient coast defence. Such a doctrine is not on the whole unique or incompatible with our way of life and thought. We are not a maritime people and have little that pertains to the sea at heart. We are geographi-

cally isolated from the world at large and have worked out our salvation unaided by outsiders. We have had our wars; have risen to the occasions; and have relapsed into quietude and lived our lives self-contained, independent, complete. Little that was really vexatious or alarming has ever come to disturb our serenity or constrain us to believe that our mere dictum was not sufficient to make our screed sacred.

Before our war with Spain the *Oregon* and her sister ships were designated in the budget providing for their construction as coast-line battleships in the hope that their nomenclature would not lead people into fancying that our navy was to go into distant seas in search of quarry. Since those times, however, we have moved forward and to-day we build Dreadnoughts and super-Dreadnoughts and are proud of our success and boast of our prowess. But our strength is not increasing relatively to the increase making by foreign nations with whom we may have to fight. Hence it follows that since we are not endeavoring to maintain a parity of strength with these foreign nations, we must be committed to a policy that contemplates an objective near our shores.

Congressional action strengthens the above conclusions. Sir Wm. H. White,[1] late Director of Construction of the English Navy has lately written that his general impression is "That the recent ship-building programs [of the United States] have been largely influenced by political considerations of the moment, rather than by definite schemes of naval operations which would have to be performed in case of war, if American interests and over-sea possessions are to be protected adequately against possible and probable attacks." Political considerations are national considerations. Therefore if Congress limit the strength of the fleet to numbers of ships only sufficient to operate in adjacent waters it follows that our over-sea possessions are of secondary importance and that the Caribbean must be controlled by our force which must not go far from our mainland to wage war.

The defensive, we must bear in mind, is the weapon of the weak, and from its very nature precludes the formulation of strategic plans in which may be included, as a part of the scheme, the movement of the fleet for the purpose of conducting lines of operation remote from the home coast, for fear lest there be no

[1] *The Atlantic Monthly*, August, 1911.

fleet at hand with which to safeguard our own immediate littoral. But on the other hand there cannot be two fleets, one of them for the defensive and the other for the offensive. "There is but one of them whose objective is the enemy afloat and which puts in action all the resources of strategy to beat him without looking back to see what is happening on the coast." Strange things, however, do happen on the coast where old men dream dreams and young men see visions, and of them strategists must take account although such matters may be extraneous to the objectives of the war; for unless the people be content to let the fleet go away from the shore the government cannot send it. To distinguish between evil reports and good reports—quantities of both kinds will be in the air—and to convince the people of the truth is a most important duty placed upon strategists and is one which they must not fail to perform with care and circumspection, else will our fleet be limited in its operations to coast defence pure and simple, an inglorious foundation for a great and mighty nation to build on.

In bringing to a close these observations on strategy we find that from beginning to end there is required for its thorough comprehension a knowledge of many things besides the three things demanding especial consideration and their adjunctives which we have been writing about. We should know something of the characteristics of a people and what they may signify. For instance, in speaking of the ruggedness of the Englishman and the Frenchman, Admiral Fiske in his article on "Naval Power," has drawn a comparison between what one may expect of ships manned by the one and by the other. Also we should consider the import of the naval policies of governments; here the statement of the Kaiser, that the future of Germany lies on the sea, is pregnant. Again, the ability of the personnel afloat and the efficiency of his material are matters of much concern; the contrast between the navies of Japan and Russia is to the point; in this case, however, we recall that the world at large misapprehended the relative strength of the contestants. Again, we should review the naval history of a nation to learn from it what may be as it were, the inheritance of its seamen. Great Britain has one that in the simple reading of it must inspire its navy to attempt great things; and our own service, too, has an equally enviable record of which we are justly proud. And again, we should constantly observe what the different naval

powers of the day are doing to strengthen their strategic position: thus when we see that a nation is establishing a new base, bringing forward an extensive building program, and maintaining a strong fleet in certain waters, we come to think that she has in mind the intention to be ready to meet a condition of affairs different from that which previously existed. Therefore of all these many things we should be constantly taking note, and—stand by for a call.

"Naval strategy has for its end to found, support and increase as well in peace as in war, the sea power of a country," a quotation that epitomises the whole matter and fully covers the subject of naval endeavor until tactics comes into play. The aim of strategy is to obtain a position of superiority at a point in the theater of war; of tactics to obtain this superiority at a point on the field of battle. Strategy leads to the fight, tactics leads in the fight. As compared with the impersonality of strategy tactics is a personal affair—rapid, visible, active. But while tactics often changes its procedure it yet is based on sound unchangeable principles. What is tactics?

TACTICS.

Tactics is defined as the "science or art of disposing military or naval forces in order for battle, and performing military or naval maneuvers or evolutions."[6] The word, like the word mathematics is properly a plural noun but is now commonly regarded as singular. In my reading I have found "tactics are" and "tactics is" and both forms sometimes by the same author, euphony apparently determining the choice.

In the tactics of the sea and in that of the land—as in naval strategy and army strategy—there are many fundamentals common to both, like turning a flank enveloping a wing, concentrating fire, etc. But in naval tactics one must bear in mind that the surface of the sea is as unlike the terrain of the land as possible, and that, therefore, the obstacles and difficulties of the one are not at all simulated in the other. Often we say that scout ships are like outriders, cruisers like troops of horse, battleships like bodies of infantry. In some respects the likenesses are admitted, but in most respects and especially in the conduct of battle there is no similarity whatever. A ship fights underway, an army at

[6] *The Century Dictionary.*

a standstill; the former delivers her fire from any and every position, the latter from only one, the front. A ship is a moving self-contained, armed and armored fortress of tremendous potentiality in a small constricted area; its mobility compared to an army's is marvelous. In the twinkling of an eye it can change front and formation and fight its battery all the while with unchanged efficiency. Hence the reasons why sea tactics in all details is different from land tactics: the former may be very broadly descibed as the movement in battle of inanimate bodies, the latter of animate ones.

Land tactics is much better understood and developed than sea tactics for the precedents are many and the changes wrought by time in the means are few. "Naval tactics"—I copy from a quotation of Mahan's—"are based upon conditions the chief causes of which, namely the arms, may change, which in turn causes necessarily a change in the construction of ships, in the manner of handling them and so finally in the disposition and handling of fleets." But although changes in armaments and consequently in ships, and changes in motive power and consequently in maneuvers, have necessitated changes in tactics, yet to-day as in the past the object of tactics is to enable one fleet to gain a position of advantage over another fleet so that its guns can be used with more deadly effect. Which is to say that when other things are equal, that commander who best comprehends the art of making good combinations preliminary to battle as well as during its progress will be the master tactician.

The art or science of naval tactics has been divided into four classifications—so writes Commander Yates Sterling in "The Nation's Defense."

(a) Distant touch (over 20 miles, when the smoke of the enemy's fleet will show its bearing, but not its formation).

(b) Visible touch (10 to 20 miles when the enemy's fleet will be in sight and some estimate can be made as to its numbers and formation).

(c) Battle approach (4 to 10 miles, when the enemy's fleet can be seen distinctly, and it can be seen accurately more or less, the course, formation and speed).

(d) Battle tactics (under 4 miles when fire will have commenced).

"During battle approach the fleets will maneuver for position advantage: during battle tactics for range advantage." This

indicates that each fleet will strive for the equivalent of the old weather gauge and then for that formation which will best unfold gun fire which will to-day be during (c) I apprehend, rather than at (d).

A fleet in search of its enemy will be so ordered that its units can in the shortest time pass into that formation which its commander believes will result in its obtaining the desired initial position which will probably be at the instant of visible touch, 10 to 20 miles, because at this distance "the relative position of the two opposing forces with reference to power of concentration, wind, weather and sun, will be determined," and soon afterwards, at from 6 to 8 miles, while approaching for battle, the firing will commence, and by the time the fleets are five miles apart it will be waxing fast and furious; then, if other things be equal, superiority in tactics will win the day.

How obtain this superiority in tactics?

Tactics to-day is still a purely theoretical subject which is disquieting the minds of naval officers everywhere, and which it is safe to say will continue to do so until the advocates of this or that system can put their methods to the test of actual desperate warfare. Our ships and foreign ships are not in themselves substantially different; but in the handling of these ships when they are assembled together so as to constitute fleets, our way is different from that followed by some of the great nations abroad. I gather from a reading of Lieutenant Pye's "A Few Hints to the Study of Naval Tactics," that the conclusion has been reached in our service that single line tactics will prove to be more effective in deciding the fate of a fleet in a modern engagement than either the double line or the group formation adopted by some foreign navies.

Single line tactics comprises three elemental formations—line, column, echelon; line for the approach, column for the attack, echelon for the pursuit. To change from one to the other is a tactical maneuver effected by three methods—the direct, the rectangular, the special. The direct leads from one formation to the other by the shortest route; the rectangular by turning at right angles, the longest route; the special by a combination of the other two. In the direct method the advantage of shortest route is offset by the disadvantage of change of speed; in the rectangular the advantage of unchanged speed is offset by the disadvantage of longest distance; in the special both the above

advantages and disadvantages appear. The foregoing explains single line tactics only in the abstract; for the concrete, readers are referred to many admirable articles in preceding numbers of the NAVAL INSTITUTE PROCEEDINGS, wherein will be found excellent mathematical expositions of numerous applications of the different evolutions to imaginary engagements between fleets on the sea.

Every system of tactics consists of successive movements, or simultaneous ones, or a combination of both, the object in all cases being to get at the enemy in the quickest way and shortest time and in the best position for using the guns both during the performance of the evolution and after the ships shall have arrived at the new position; for the crowning effort of all tactics is efficient gun fire. Therefore that system of tactics would seem to be the best that secured this preponderance of destructive power by the simplest methods and those most readily comprehended by the men who have to apply them; for the commanders of the different units of which the fleet is composed are responsible for the control of the movements of their ships as well as of the fire of their guns; their hands are very full, and the less they have to do with the complications of the signal book, the more can they devote their attention to the guns and the position of their vessels with respect to them. Commander Daveluy, writes in "A Study of Naval Strategy":

"Here is the idea of command we find in 'Tactics of Ships in Line of Battle,' by Lieutenant Niblack. A commander ought to have four things under his immediate orders: The speed, the course, gun fire, torpedo fire. Moreover, he ought to be in a position to know at each moment by means of the interior communications: 1. The helm angle. 2. The number of revolutions. 3. The distance of the enemy. 4. The distance and bearing of the guide vessel. 5. If each division is ready to fire. 6. If each torpedo tube is ready to fire. 7. The hull damages. 8. The number of degrees of list. The officer who has to meet all these requirements is nothing more than a registering apparatus."[7]

The criticism is unfair. To have things like speed, course, gun fire under his immediate orders is the reason why he is given the command of his ship. Further, to be in a position to understand things is different from the requirement that he himself should constantly have absolute knowledge of them. What he must know and what he does know is the significance of such

[7] Translation by Professor Alger, U. S. Navy.

information when it is given to him by his assistants who stand by to supply it when needed, as well as a good deal of other information not mentioned by Niblack. He must be prepared at all points to do the will of his commander-in-chief, and to this end he must know everything about his ship, not as a registering apparatus, but as a thoughtful, wise, intelligent seaman.

If the captain's life is not a happy one while he is endeavoring with all his might and main to handle properly his ship during the maneuvers of battle tactics—and we cannot maintain that it is otherwise—what must be the feelings of the commander-in-chief who has these instruments in his hands to make them play true and who by the skilful use of them in the developing of his battle tactics has the means of obtaining the victory if he comprehends how to make them conform to the necessities of the battle field? The difficulty in the situation, arises of course from the uncertainty as to what will be the tactics of the enemy. If he come to the fight in double column as did the Russians at Tsushima, the problem is too simple to need explanation. He is opposing the bow fire of a few guns to the broadside fire of many, and when the heads of his columns turn, he offers a fixed target for concentrated fire attack and consequent destruction. But if he be as clever as you and as determined to fight, he will be in battle array when met and the contest at the beginning will be for the weather gauge or the initial position with a view to that disposition of the fleet which will enable it to concentrate the fire of a number of its guns on some portion of the enemy. How many of these guns shall be assigned to this work of concentration, and what part of the hostile fleet shall be singled out to be overwhelmed by this volume of gun fire, will, indeed must, depend upon the tactical formation of the enemy and upon our own line of battle. If both fleets make use of line tactics, both will come up to the scratch, in all probability, in the same order in parallel lines or slightly converging lines, and at 12,000 yards to 14,000 yards or 16,000 yards the ball will open. Shall all the guns of our fleet at this dance of death be concentrated against one ship of our enemy, or against two ships or three, or shall each ship in our line endeavor to pick out an opposite partner with whom to engage?

The answer will depend on the enemy—his strength in numbers, in guns, in accuracy of fire, in mobility and in discipline. I think our line should concentrate against one unit of his line so

ng as the range of firing exceed 12,000 yards to 14,000 yards r over, for the loss of one of his ships must sensibly diminish he tactical efficiency of his fleet. If his line and our line are early abreast at these great distances, I would concentrate my ire on two of his ships; if possible the two flagships nearest the ead and center of his line, for if they were removed he would e seriously handicapped when he closed in and the battle tactics t distances of about 10,000 to 12,000 yards began. At these istances, about six miles, I would suggest the concentration of ree ships against one ship. Then, when our maneuvers brought s to within about five miles, I would order ship to fight ship. This suggested plan of conducting the fire tactics of a fleet is ounded on the supposition that the hostile fleets seek a decisive attle, and that the battle tactics of the two will be in essence the ame, each contestant, however, watching with intentness the ther, ready to take advantage of every chance that may be ffered for gaining a position of superiority. If no such chance e offered and the opposed fleets be of the same strength and fficiency we arrive nowhere, for all things will be equal, an tterly absurd situation as was pointed out in the beginning of his article, because it eliminates the human factor, the most ariable of all the factors in the world. Since, therefore, it will e a human impossibility for the two hostile fleets to act in com-mon, employing the same maneuvers, at the same time, in the ame way, the question for tactics to decide is what will the enemy do and what will we do? Who is to be the better man?

I venture to suggest that the science of mathematics cannot give us the answer; neither can the game board. Mathematics s an exact science: there can be but one line of reasoning, and but one answer to the problems. Tactics is not at all an exact science; its movements are not in sequence, its reasons are not logical and its results cannot be foretold or forfended. On the game board the same man attempts to play two parts: I, an American, inborn, inbred, ingrained, attempt to maneuver, say —the German fleet, to do so like a German; the thing is a psychological impossibility. I do not wish to aver that mathematics and the game board are of no account and ought, therefore, to be discarded in the study of naval tactics and strategy; for as a matter of fact I hold a contrary opinion. By the use and comprehension of both we should be enabled to discover elemental truths and errors and to agree upon the fundamentals of the

system of tactics we wish to adopt; and from these principles to evolve a signal book with which we can drill our fleets and attain to a high degree of proficiency which will stand us in good stead whatever system may be tried in opposition.

After an engagement between two fleets has lasted until one of the antagonists has gained such tactical superiority over the other that the latter has begun to disintegrate, the melée is sure to follow when each ship individually is expected to go into the fray and take care of herself without the restraint hitherto imposed by tactical considerations and the orders of the signal book. When the Spanish squadron emerged from Santiago, a single signal, "the enemy is coming out," was sufficient. In what ensued there was no tactics to speak of; it was a case of every man for himself and the devil for the hindmost, with both the pursuer and the pursued. Not dissimilar was the tactics of the Russians and the Japanese during the sortie from Port Arthur. But at Tsushima there were battle tactics by the Japanese from the start almost to the finish; and it can be said that Nelson always used tactics to enter into his great sea fights. But he also informed his captains that they would not be held responsible if the misreading of a signal caused them to lay their ships alongside of the enemy—which they promptly did during the melée. Superb tactics was that of Admiral Farragut entering Mobile Bay and splendid his taking the lead—a perfect example of the power of a man to seize his opportunity; but later when the *Tennessee* came at him with a rush, it was ship to ship that fought. And it cannot be otherwise; for as the battle progresses ships sink or fall out or are cut off; disorganization ensues, and there can no longer be, because of the attending state of affairs, any tactics or any further use for it.

Speed, mobility and discipline in a fleet are the essentials of tactics. Of speed volumes have been written and the number is not yet finished. It plays a part in the struggle for initial position. But even here this position need not be lost on account of inferiority in speed, for it is difficult to establish which of two fleets is the faster, and it is an error to suppose that a difference of speed exists because one of two opponents changes his bearing, or to conclude that the speed of both is the same because the bearing remains constant. And after all what does it matter if both fleets mean to fight! The faster fleet will be on the outer circle, the slower on the inner, and his guns can carry no further

than yours. Superior mobility rather than superior speed will help the winning tactics. The ability to change course, turn quick, offer broadside, bow or stern, stop, go ahead, all with greater celerity than an enemy, gives you a tactical superiority that places you at an advantage over your less dexterous opponent. With moderate speed relatively, decidedly better mobility and a fine discipline, we are well off tactically.

By discipline I mean skill in the practice of performing tactical maneuvers, a ready comprehension of and familiarity with the signal book and a thorough apprehension of the strength and mobility of the components of the fleet. Practice will make perfect. I suggest, therefore, that for this purpose and also for strategic instruction, our fleet be divided into halves, one-half to go to latitude x, longitude y and from that position to attack the Panama Canal which the other half will defend. Confine the sphere of operations to the limits set by the Chesapeake on the north and Trinidad on the south and restrict the time to about two weeks; and let the battle rage. Make few rules to govern the game, for in real war no rules hold between belligerents; and permit the use of every means a fleet might employ or resort to in time of actual warfare, such as the holding of bases and stations, communication with the strategic board at headquarters and the employment of aeroplanes, wireless telegraph and telephones, cables, despatch boats, torpedo craft, scouts, auxiliaries, etc. After the completion of the winter exercises on the southern drill ground, divide the fleet again, changing admirals and ships, and again simulate war on the northern rendezvous. In other words, make of every cruise between the northern and southern drill grounds, a battle. The determination of the results and the lessons to be learned, might be assigned to the War College and that institution might issue its conclusions in the form of an elementary guide book of tactics from the use of which might be evolved in time, a satisfactory system of tactics. So far as I know no such system is in present use. I beg to suggest in this connection, that captains, as many of them as can be spared from other duties, be detailed to the War College for instruction, for they are the men on whom will fall the responsibility of command when the war does come, therefore they of all others are the men who ought to cultivate their gardens.

Tactics in the last analysis means gun play; and it is solely for the purpose of participating in this play to the fullest extent pos-

sible with the means at our disposal that war ships are designed, built and manned. It is solely with this purpose in view that our ships are drilled, our fleets maneuvered and our system of tactics evolved; and it is solely from this point of view that strategy is developed and provision is made for the future. Or, we may say, strategy leads to tactics, tactics to gun fire, and gun fire, if superior, to victory. Hence it follows that in the fleet, and in the units of the fleet, in all things that belong to them, that touch them, everything must conduce to one end, gun fire. In the restricted meaning of the word gun fire, that is, in target practice or in the domain of making bulls'-eyes, our navy is second to none. Therefore if we can deploy our fleet so as to be on at least even terms with our enemy—if our tactics is as good as his; if we can reach the theatre of action at least as soon as he can—if our strategy is as good as his; then if he proposes to fight it out, "we have the guns, by jingo!" This leads us to the thought that, other things being equal, we have the remaining thing, an obtrusive statement whether true or not.

Until the invention of gun-powder the only weapon inherent in a ship was the ram. Then came the gun the only weapon of Nelson and Suffren. At the Crimea appeared the armored ship and then came the two weapons, the ram and the gun. Farragut relied on the gun and wooden walls though there were monitors and armored rams in his day and he fought both; yet he stated that the best defence lay in one's own rapid fire. At Lissa both rams and guns were used and because one ship was sunk by the ram of another, enthusiasts assigned as conspicuous a place to the ram, when working out problems in tactics, as to the gun. There is no question that ships accidentally in collision have sometimes been sunk by a ram; and sometimes not: the White Star steamer *Olympic* when struck full force by the English cruiser *Hawke*, closed her bulkhead doors and successfully limped back to port; but the *Hawke* lost her bow built for ramming, and so she, too, with doors closed and in addition with collision mats over her bow, limped back to port in safety, but in a useless condition for waging war. War ships are still built with ram bows for offence, but that the ram will ever be again used in warfare seems to me beyond the bounds of probabilities.

Next came the torpedo, it is a terribly destructive weapon and there are many officers of great ability who believe that its future will be as brilliant as the guns; therefore, we find it installed in

battleships, cruisers and other types of war ship. Nothing that I have read of the use of the torpedo in warfare, real or simulated, inclines me to think that capital ships can accomplish as much with it as with the gun. On board torpedo craft and submarines the torpedo is the special weapon placed there for a special purpose—for coast defence and dashing work near a base: even so, however, in peace practice it as often runs false as true though circumstances are in its favor.

The moral force exerted by the torpedo has at times been quite as potent as the destructive force, but that the dread of either force will hereafter exert any influence in shaping the tactics of fleets in action is problematical. We open fire at our enemy when 6 to 8 miles distant and we keep it up with greater frequency and accuracy the nearer we approach. It seems incredible that both of us could live to come within 6000 yards—three miles—when the torpedo might become effective. If, however, this distance be reached and our guns be not able for some reason to demolish our enemy, then let the torpedo craft—not ourselves—shoot the bolt; though here we must remember that a battleship mounts 20 or 30 rapid fire small guns on purpose to render such attempts abortive. "If I were king," I would remove torpedoes and ram bows from capital ships and give the weight and space to ammunition. The torpedo boats and vessels I would have and those that were sea keeping I would send out with the fleet; the others I would hold for shore defence; also the submarines. To encumber a battleship with a submarine, as someone has suggested, would be, I suggest, a bit of a mistake.

Fleets comprise three types of vessel—battleships, cruisers, torpedo craft, armed with guns and torpedoes. In the first two both gun and torpedo are the weapons of the offence; in the last one the torpedo only is for the offence, the gun is for the defence. The battleship type is the armored type and may be subdivided into battleships, battleship cruisers and armored cruisers. They constitute the offensive strength on the sea of the nation that owns them; and such of them as can be placed in the main line of battle are known as capital ships. Cruisers may be subdivided into scouts, despatch vessels, gun-boats etc.—an unarmored type, the fighting adjuncts of the armored fleet. They perform minor duties; protect bases; and those—of them that can be used for scouting and reconnoitering are indispensable; the more of them the better. We demonstrated our weakness in scouts by letting

the Spanish squadron enter Santiago undetected: the Japanese proved their value by locating the Russians long before the battle began.

Torpedo craft are divided into boats and destroyers. The latter, the sea keeping class, grows larger year by year and will soon become in fact a scout, and with its great speed and habitability may be used as the quick restless eyes of the fleet. With increase of displacement will also come a corresponding increase in radius, gun power and all round efficiency. In the course of time, therefore, we may be led to the belief that perhaps our sea going and keeping navy ought to consist of only two types of ship, the all big gun battleship and the large sea going torpedo vessel. If this should come to pass and the proper proportion of the two types be observed—one battleship to four destroyers—the question of tactics would be somewhat less annoying.

How many ships of each type shall we require to meet adequately the possible exigencies of a war waged against a foreign foe? In other words, what shall be the strength afloat of our navy? The answer must depend on what may be our international policy. Admiral Mahan states the matter as follows: "The question for the United States, as regards the size of its navy, is not so much what it desires to accomplish as what it is willing or not willing to concede."* We have the fixed intention of holding the Panama Canal for ourselves alone, and of vigorously supporting our own construction of the meaning contained in the Monroe Doctrine. In these two particulars it is safe to say that we are not willing to concede anything. Therefore must we have knowledge of the forces of those foreign powers whose activity on the sea may lead us to suspect that perhaps at some future day they may challenge our ability to maintain secure that which we now possess. With this knowledge of the strength afloat of a possible enemy, we must, if we would sustain our policies, keep abreast of, or to make sure, a little ahead of, the naval movements of these foreign powers.

Now this keeping on at least a parity with other nations, may not appear at first sight as a hard thing to do; nor is it if we consider only the personnel, the fighting spirit and the aggressive character of the ship itself. But when we include in our consideration of the navy all its parts, viewing them as a great and

*The North American Review, September, 1911.

mighty national institution, we encounter difficulties because of the manner in which our naval establishment is provided for, a manner different in principle from that customary in some foreign countries. For instance, the German government puts in motion a carefully worked out plan of naval expansion which we know will be consistently adhered to. Its execution as well as its inception belongs to the executive branch of the government, the legislative branch votes only the funds. In our country the legislature not only votes the funds, but it controls the entire naval establishment, administrative, executive, financial; navy yards, bases, fleets, ships, officers, men—all are under the will of Congress, and this subjection is not good for its consistent expansion and steady improvement, for its efficiency and its morale.

When we see that a foreign navy is augmenting an already powerful fleet we conclude that the increase will place that nation in a position to compel us to concede some things which we ought not to be willing to concede. We therefore lay the facts before Congress and request that our hands be relatively strengthened. This is all we navy men can do. Our fate rests with Congress. Hence the true answer to our question "How many ships shall we need? becomes academical, for it will depend not on what the navy department may submit as the proper number but on the opinion of the majority of the members of both houses of Congress. Sir Wm. H. White has written* that in the next three years Germany will have overtaken the United States in the number of capital ships when the vessels now building or decided upon in both countries are completed. Germany will then possess 17 of the Dreadnought type and our navy 10. Then as between our country and Germany, other things being equal, Germany will possess the remaining thing—seven more capital ships than the United States.

From the above point of view it is plain that our condition is not altogether reassuring if we hold to the idea that it is worth our while to maintain a status of superiority as regards the security of the canal. It may be argued that an attack on the canal must be made in near proximity to our shores and that therefore the need of having as a whole a number of ships equal to the whole number in the German Navy is not evident, for any foreign power would because of the distance from the appre-

**Atlantic Monthly*, August, 1911.

hended theater of war, have to retain for the safe guarding of its own littoral a larger force than we would have to hold at our home, our distances being so much the shorter. I should say that while to a limited extent this might be so, yet it cannot be proved that it must be so. On the other hand, I think it must be admitted that if we are in numbers the equal of an enemy we are by so much in a better position to contend with him on at least even terms.

The men of the navy can shape naval policies; draw up plans; arrange programs, and construct fleets: and we ought to be able and be sufficiently interested in our profession, to attend to these scientific and expert affairs better and more whole heartedly than civilians however intelligent and painstaking they may be. But be this as it may, we can unquestionably and by unanimous consent, fight our ships better; and this function permitted to us, we undertake with alacrity and we assume the responsibility with gladness. When our countrymen see a hundred of our ships at the mobilization of our fleet in New York Harbor and gaze with pride at the 24 battleships there, they shout hurrah, and go home with the idea that we can whip all creation. We can't, as a matter of course, for, if other things be equal, as pointed out above, our 24 capital ships can be over-matched by the 30 equally efficient capital ships of some foreign powers; so perhaps they might do the whipping. However, the value of these capital ships depends on the number of guns they carry; the guns depend for their value on the number of hits they can make; the hits on the men behind the guns; the men on the officers and captains, and these in turn on the commander of the fleet. If our admirals be the smartest and ablest of all other commanders, so will our officers and men be cleverer and more skilful than others, and our gun fire will be more accurate, our ships more efficient, our tactics more scientific, our strategy more convincing.

To secure this condition of certitude in respect to our navy, we must cultivate that habit of mind which will have as its sole object, irrespective of the right or the wrong of a quarrel, or the chances of winning or losing, the prestige that inheres in the concept of the offensive. "Everywhere" writes Captain Darrieus, French Navy, about the English fleet, "Everywhere is combative ardor from the commander in chief to the last sailor. Each one knows where he is going and what he has to do, so that all efforts tend to a single object and work with an irresistible

force. This is the offensive spirit in the full acceptation of the term and the idea." It is forcibly expressed in the doggerel,

> "Thrice is he armed that hath his quarrel just;
> But four times he that gets his fist in fust."

To be "fust" on the field and to take the aggressive, to be fast and furious, have, even when other things have not been equal, often won the day. Nelson with forces inferior in number to his opponent won his two greatest naval victories by assuming unhesitatingly a vigorous offensive: and Admiral Farragut by his strenuous application of the principle saved his fleet at Mobile, and won many other victories. Hence we see that with even an inferior force, the man with the more indomitable will can overcome many inequalities and difficulties. This ascendant power of will Admiral Fiske aptly calls "spirit," and this it is that has inspired the officers and men of the fleets and armies of great captains to fight bravely—Napoleon's presence on a field of battle, despite the proverb that Providence is on the side of the big battalions, was said to be equal to a reinforcement of 30,000 men; and Mahan adds—"Providence is most often on the side of men who best know how to manage their battalions, or their ships; the smaller have more often triumphed by their conduct, than the bigger by their weight."[10] I think that the significance of this "spirit" as the dominant factor not only in making a navy great and powerful, but also a government, is well exemplified in the supremacy of the world attained by the Roman arms. When the Romans went forth to war the gates of the city were left open in accord with the haughty courage of the Republic which commanded victory by not admitting the possibility of defeat. Of what avail the subtlest strategy, the cleverest tactics, the finest ships if a haughty courage be wanting! How can we, as a nation or as a navy, accomplish aught of value if we stand in pause instead of not admitting the possibility of defeat! If all other things in the world are in our favor but the one thing of enthusiasm for and belief in the offensive and the abilities of our superiors to win and in ourselves to help, in the spirit which made one Confederate fancy himself the equal of three Yankees, we cannot win. If we go to the fight expecting to be beaten we'll not be disappointed.

[10] "Reflections . . . . suggested by the "Battle of the Sea of Japan," by Capt. A. T. Mahan, NAVAL INSTITUTE PROCEEDINGS, No. 118, June, 1906.

THE PERSONNEL.

Who are these men, our superiors, who are to instil this spirit of *dulce et de corum est pro patria mori* in us and animate our actions, and how do they attain to the distinction of greatness? By greatness is here meant the universally acknowledged attainment of leadership by the performance of acts and deeds that are extraordinary in the benefits or advantages resulting therefrom to the nation to which the performer owes his allegiance. This position of recognized ascendency of one man above his fellows is reached and held by him because of his superior prescience, forcefulness, abilities and education: he perceives intuitively the right thing to be done and he knows from his education and practice the best way to do it. Some men "are born great, some achieve greatness and some have greatness thrust upon them." We may say, for example, that some sovereigns like Queen Elizabeth and the present German Emperor were born great; some men like Nelson, Napoleon, Grant, Lincoln, achieved greatness, and some men like Farragut, Porter, Dewey, Sampson, had greatness thrust upon them. In our navy only the last kind of greatness is likely to be thrust upon us for ours is a service in which every officer will eventually reach the rank of command when he may expect to receive orders to assume the leadership of a fleet and engage the enemy; and be given the opportunity whether wished for or not of winning the laurel.

We are cast upon the tide that may lead to fortune—fortune in the sense of fame—at Annapolis. "Is the present system at the Naval Academy," asks Lieutenant Cresap, "the best one for achieving the purpose for which the government maintains it"?" Evidently to many it is not the best system. Too much theory says one; too little, says another. More of the practical, less of the practical; general principles only, specialization alone; a five year course; a six year course; etc.—all have strong advocates. There is, I venture to suggest, a deal of stuff taught at Annapolis in the endeavor to make a square peg fit into a round hole, but none the less we are all pegs, and when not in our holes all alike so far as our usefulness for one general purpose is concerned. I read, "Many persons believe that the efficiency of our navy would be increased 100 per cent if every officer"—note that —"and every man were a trained seaman." Lieutenant Taylor

[11] June PROCEEDINGS, 1911.

Evans leaves no doubt as to his meaning, for he further says; "It is often advanced that a knowledge of seamanship is useless to an officer; if so it would be better to close Annapolis and borrow from the second lieutenants of the army." Ye gods and little fishes! Are we to learn to back and wear, back and fill and to chapel ship? Whatever that may be, I don't recall it in Knight, What for? Because Farragut in a steamer, Worden in a monitor, Togo with an armored fleet, learned their business in sailing ships; and further, because an officer of one of the stately ships of the merchant service must receive his training in a sailing ship? The reasoning is not conclusive.

To know how to hand reef and steer—words of archaic signification—did apparently quicken the faculties and stimulate the activities so that, in some unexplainable way, an officer acquired the art or science or power, whatever we may choose to call it, of managing, controlling and working his ship and crew with ease, assurance and confidence. Was this so because the brotherhood of sailors was closer than is that of seamen? Was it because "To lay aloft in a howling breeze," inculcated in young men that mighty spirit of which we have written, and which remained steadfast with them from youth to old age, and carried them all, midshipmen, lieutenants, captains, admirals and the crews triumphantly through the jaws of death? There are men of the old navy who will answer you, yes. There are men of the new navy who will tell you, no, notwithstanding the assertion of Lieutenant Taylor Evans, that "The history of the future will bear out the assertion that, other things being equal, superior seamanship will decide sea-battles."[12]

In the old navy, life on board frigates and sloops was as simple and open, as above board as were the ships themselves: officers and men rubbed elbows; and from captain to powder boy every man knew every other man; and seamanship narrow and broad, concrete and abstract interested all hands. In the new navy, life on board a battleship is, forward and aft, complex and diverse with its departments and compartments and organizations. We too, however, are proud of our ship, our target record, our football eleven; but it is as they approach the perfection of a machine that we admire them, the individual whether officer or man, is merely a cog. I asked an ex-apprentice, the other day, who had

[12] U. S. NAVAL INSTITUTE PROCEEDINGS, No. 138, June, 1911.

served his time and left five or six years ago, who was the captain of his ship? He answered, Fitzgerald. Fitzgerald I happened to know was a boatswain's mate. I mentioned the names of his captain and executive officer but he had no recollection of ever having heard or seen either or any other officer. I wonder whether these officers even the midshipmen, knew Fitzgerald. Perhaps they may have seen him running a hawser while the midshipmen were below working at "Strength of Materials," instead of learning not only how to run a line in a seaway but also how to command the boat's crew and Fitzgerald too. Here again I by no means wish to aver or imply that mathematics is not necessary to the making of an efficient officer. On the contrary, I assert now as heretofore that it is a *sine qua non*. But as a distinguished American divine said when he dismissed his congregation upon the approach of the British troops, "There's a time to fight and a time to pray and now is the time to fight." It is our failure to discriminate the time that in my opinion has something to do with our lack of seamanship.

Annapolis ought to fit a man to be a midshipman and not at all an admiral or a captain or even a lieutenant notwithstanding that in time he will be a lieutenant and a captain and an admiral. That these greatnesses will be thrust upon him is as sure as fate; but the way from the subordinate first rank to the high and mighty last one is hard and toilsome and each man must play many parts, his acts being seven ages. At first the whining school boy at Annapolis, corresponding in some respects with the infant mewling and puking in his mother's arms, of Shakespeare's ages. And then the graduate learning that he is a man and can grow a beard and will have to handle men. Then the lieutenant "full of strange oaths," for now he has young officers as well as seamen under him to do his bidding, and he has charge at times of the peopled deck. Then the lieutenant-commander with more men and officers to command: sometimes he has to navigate his ship; sometimes be her executive; and he may even be given the command of a small vessel: he must be a man of some parts. And then the commander; the first lieutenant, or the executive officer of a big capital ship or the captain of a smaller ship Many cares, responsibilities and duties are his: he must be a man of fine sense and of force, for it may be that above him there stands but one man while below him are many men who rely upon his judgment and depend upon his acquirements. The sixth age shifts into

the captain; a man of might; an overlord, who has the lives and happiness of many officers and men in his keeping, and the efficiency and safety of the great ship under his eye and hand; a position of great dignity and trust and importance, requiring wisdom and experience and knowledge. Last scene of all the admiral; a title borrowed from old Arabic where it signified then, as it does now, the ruler of the sea. He is commander-in-chief of the fleet; and all that therein is is under his control. His apprehension must be extraordinary; his perspicacity acute; his professional attainments of the highest. He is the exemplar entrusted with his country's honor.

Our life is a full one, and an anxious and a trying one, for we, ourselves, are well aware how easy it would be to fall into the quiet unconcerned ways of peace and to pay slight heed to the needfulness of being prepared for war. But for us naval men there ought to be no peace whether our country be actually at war or not; and our minds ought to be occupied with the fighting of battles in imagination if not in reality. Though peace hath few victories for military men and none at all for American naval officers, yet none the less while it lasts, be the time long or short, we must keep on edge obsessed by the idea that war will be on the morrow when we shall be weighed in the balance.

In connection with the requirement that we be always trained to the minute, we men of the navy of the United States may be thought to be at a disadvantage in a comparison of our lot with that of officers of the army and of some foreign services where what is reckoned as greatness may be achieved by extraordinary exertions off the field of battle as well as on it: the bubble reputation is there for them to seek even though it be not at the cannon's mouth. This prize cannot be competed for in the same way among ourselves in the navy. With us, a captain, for instance, cannot displace or go ahead of an admiral no matter how much better qualified he may be than his superior to hold a command; he must bide his time and wait his turn. We may think that perhaps such an arrangement is not calculated to stimulate ambition or bring out the best efforts; and certainly it has been exclaimed against by some of the able men in our service; and promotion by selection has been strongly urged. On the other hand, it can be averred that promotion by seniority does, on the whole, make for content; a praiseworthy state of mind which obtains to-day to a greater degree than ever before, because under

the present system of retirement, the incompetents, from whatever cause, are plucked, and we who escape, apprehensive lest our turn come next, rest no longer satisfied with the mediocrity of other times, but instead, strive to do with all our might whatever our hand findeth to do. The success that has attended our endeavors can be measured in many directions by the ships that now compose our fleets, by the efficient manner in which they are managed and by the enthusiasm of the officers and men in the performance of their manifold duties. Can these fleets accomplish to-morrow the purpose for which they are held in readiness to-day? That purpose is the command of the sea; and whether our fleets shall achieve it or some other fleets will depend on the strategy, the tactics, the guns and the personnel; and most of all, perhaps, as we have said before, on the commander-in-chief.

From the foregoing it follows that the command of the sea may be expressed in the term of an individual. Nelson was the embodiment of the sea power of Great Britain, writes Mahan. Yet Nelson sometimes made mistakes in strategy, as, for instance, when he sailed in the wrong direction to intercept the French fleet; and in tactics, too, incomparably brilliant and successful as they were, as, for instance, when he bore down at Trafalgar in two columns upon the French line at right angles to it, and offered thereby two points for concentrated attack. This tactics was not unlike the Russian approach at Tsushima. Maybe the Russian admiral had read of Nelson; if so he had not read deep enough. Then why is it that Nelson has achieved the unique distinction of being the greatest sailor that ever sailed the sea? I doubt very much if he equalled his enemy as a strategist, for Napoleon controlled the movements of the French fleet; and as a tactician he was not, on the whole, the superior of his enemy. True, his courage was consummate, his faith unbounded his determination irresistible; but many another man has these qualifications of leadership; and undoubtedly his enemy was personally as brave as he. But Nelson's fleet, as well as Nelson, loved to fight; his enemy's did not. Therein lay the difference, all the difference, between them that made all things unequal. This lust for the fray had been inculcated by Nelson himself—his personality, his enthusiasm, his influence. "This Nelson," wrote one of his captains, Duff, "Is so loveable and excellent a man, so kindly a leader that we all wish to exceed his desires and anticipate his orders." Is there any wonder that the English fleet of those days was Nelson's fleet,

soul and body, and that in him was incarnated the command of the sea?

Another name comes to mind as an inspiration and model in recalling the deeds of those great captains to whom sea power and command of the sea were synonymous—that of Farragut. Farragut's opportunities were different from Nelson's and his task dissimilar, for he fought not against fleets but against forts, not against foreigners but against friends; but his operations were for these reasons none the less hazardous and none the less remarkable; and the qualities of his leadership none the less skilful and none the less eminent. "I will attack," he said, "regardless of consequences, and never turn back." And as a consequence we have in the annals of our navy, New Orleans, Vicksburg, Port Hudson, Mobile Bay. We may say of such men as Farragut, Nelson and of others like them, that they never know when they are beaten. Are they ever beaten? It was the contemplation of Farragut's character that led Admiral Belknap to write, "Ah! that is the sort of men we want Annapolis . . . to turn out. A man who knows his own mind, has the courage of his convictions, believes in himself, and in the loyalty, devotion and intrepidity of the officers and men he commands under any circumstances of peace or war. An officer whom to know is to love, whose subordinates, in their great trust and supreme devotion, will follow to the death."[11] I beg to call attention here, as elemental in the shaping of the character of these two great seamen, Nelson and Farragut, and as a governing influence in their lives, to the strong, firm, enduring belief of each man in God. In all the letters of the most private and sacred nature written to those whom they loved best in this world, and also in their occasional private and public utterances, there is evident that simple, child-like reliance on the strength to do duty to be got from on High. There was no rant or cant or affectation about this belief in the power of the Almighty; it was genuinely there an integral part of each man's being. The question comes; will, if all other things be equal, the victory fall to the man who lifts up his heart to God?

We perceive from what history records of those heroes who have won victories on the sea, that not only did they have a knowledge of many things like strategy, tactics, gunnery, human

[11] Admiral Goodrich in "Esprit de Corps," U. S. NAVAL INSTITUTE PROCEEDINGS, March, 1898.

nature—their own and their adversaries—but they likewise possessed intellectual qualities of a high order. First, insight—the skill in discerning at once the central fact in any situation or combination—the germ of victory. And next foresight—the power of seeing how principles are to work themselves out or can be made to work themselves out. This signification of insight and foresight was given in explanation of the successful conduct of the strategy and tactics of the diplomacy of Germany, conceived and executed by Bismarck. I have appropriated it because it is of the essence of naval success quite as much as of diplomatic success. Insight means discernment, penetration, quick perception: you fathom your opponent's mind, you divine his intentions, you anticipate his movements. Foresight means precaution, prudence, regard for the future: you know who your opponent will be, you secure your interests, you prepare your plans, you make ready to meet him.

How is a man to learn so much? How can he be prepared at so many points? For we expect him not only to know the strategy, tactics, ships and men of his own navy, but also to have an insight into the movements of his enemy, and a foresight of the principles of his naval policy and how he will apply them. I suggest that he can learn much about ships, tactics, strategy and men, by going to sea constantly during the earlier years of his career, until he reaches the rank of commander, and studying the histories of American and foreign navies. As a commander I would have him take his trick at the War College, and not promote him captain until he had done it. As a captain I would have him take a second trick at the War College, and not promote him admiral until he had done it. No, gentle reader, I am not a War College graduate; I have only seen the institution from the deck of a ship. "The final result of a properly conducted war college course is that those who have profited by it are better fitted to solve the questions arising in the conduct of departmental preparation for war (general staff work), than they would have been had they not had the advantage of formal and regular instruction in the art of war, and the course of study has at the same time developed their capacity for assuming in their own persons the responsibility of leadership which cannot otherwise be learned in time of peace."[14]

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[14] "The Field of Work to Be Filled by a Naval War College," by Capt. Wm. L. Rodgers, June, 1911, PROCEEDINGS.

In dwelling on the graver and larger matters that fall under the cognition of the naval officer to whom such knowledge is of vital importance if he aspire to secure for his country the command of the sea, only a few words here and there have been spoken of the materialistic side of the navy, the side he learns most about during his younger life on board where he lives, moves and has his being among the tools with which he must then and thereafter do his work; a work the successful accomplishment of which depends in a measure on his ability to master the principles and the capabilities of perhaps the most notable production of the scientific and the practical men of the day. The ingenuity and skill displayed in making a battleship the most powerful engine of destruction in the world are altogether wonderful; and the inventiveness exhibited in designing the means wherewith to obtain this power is altogether marvelous. We find in the designing, building and equipping of our ships every principle of science and every device of man brought into practical use for the express purpose of developing the most perfect means which will enable a man to destroy his fellow man. Altruistic by nature and living as navy men are, yet of all men are they by training and habitat the most ferocious. The paradox is explainable in a measure perhaps by the fact that of all men, navy men have the least to do with the bringing on of a war. They are not taken into the counsels of those who decide that a crisis has arisen between our country and another country which necessitates an appeal to arms; and they are not instrumental in shaping public opinion and demanding redress for insults. None the less, however, are they the ones who must settle the quarrel by the skill with which they use their ships to destroy other ships and kill the people on them. In order that we men of the navy shall perform this duty of killing our fellow men in as thorough a manner as possible, we devote our time and thought, our energies and our intellect from the day we enter Annapolis until death absolves us from further participation in this glorious existence. An existence of which honor is the mainspring and "our country, right or wrong" the controlling principle. Base hirelings we have been called—hirelings if you choose, but not base; there is nothing base about the American naval officer; and the pay he receives precludes the thought that he serves for lucre. He serves because next to God, he loves his country.

"What joys, what glories, round him wait,
Who bravely for his country dies."

The ship in which a naval officer serves his country and hopes to win joys and glories is the outward visible sign of the physical force of a navy, and is typical of the sea power of a nation. More particularly as we have said before is the capital ship illustrative of a state's sea strength because to her rather than to any other class of vessel is assigned the role of fighting for the command of the sea; for this purpose is she built and commissioned, and for none other. Look at her! She is to-day an immense floating machine of astonishing complexity and can be made to function properly only by men skilled in the use and understanding of mechanical contrivances and inventions. We press buttons, heave over levers, open valves, and wonderful results follow. It has been jocosely remarked that an old time officer when assuming command to-day finds himself as bewildered as Alice in Wonderland; a state of perplexity not surprising, for the rapid march of events cannot be kept step with by an officer doing duty along other lines.

Some thirty years ago the building of our new navy was begun. Then was written; "Never has there been a period in time of peace, when such large expenditures were being made for naval purposes as at the present, and never a period in the history of steam screw navigation when such radical changes were being effected in the construction of ships of war, in the mechanism of steam propulsion, and in the application of machinery to various purposes on board ships hitherto accomplished by hand. Never before have such vast strides been made in so short a time in the fabrication of great guns for naval warfare, necessitating, of course, the introduction of new mechanical appliances for working them." [15]

There is no word to alter in applying the above description of naval development thirty years ago to the situation of the present moment. It may have been an exceptional epoch then, if so, it is so no longer, for among all the nations of the globe there has never before been exhibited such naval activity as at present. And furthermore this activity will be found to be quite as energetic next year and the next and so on to the end of the chapter. For so long as we hold to the militant policy that the Panama Canal shall be distinctly ours we must build the best ships in the world. Similarly to support their policies other nations must have what

[15] "The Warships and Navies of the World," by Chief Engineer J. W. King, 1881.

they consider to be the best ships in the world. Hence however much we may wish for a reduction of armament, we may rest assured it will never come and that the race for supremacy in battleships, and other ships also, will never cease. For, if all other things be equal, the most modern ship especially the battleship will be the best ship.

But it may be asked, how are we to know that in the development of the capital ships here and abroad our ship is the best and will be the best? We don't know; and we shall not know until the time comes when we oppose our ships to those of an enemy. While, however, we spare no efforts and expense to produce a ship that in herself shall be the superior of every other ship of her kind, yet all the time are we fully conscious that if we put the best of tools into the hands of inefficient workmen, we shall not obtain as satisfactory results as we would were the tools less efficient and the men more so. This brings us back to the man, to a consideration of his fitness rather than to the warlike qualities of his ship; for it is the navy officer who must fight the ship. Only when two opposing men are equal in every respect will the question which is the better ship, his or ours, be positively answered. But no two men can by any possibility ever be the same under the same or under different conditions, even though their ships as mere ships may be—as was pointed out in our beginning. Therefore do we return to where we originally started that, other things being equal, the remaining thing is the man.

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We commission a battleship, a war vessel common the world over, designed with the idea that our disposition of her guns and armor is better suited to the work in hand, fighting, than another man's, our enemy, whose ideas embodied in the ship he commands, are the same as ours. We combine a number of our ships into fleets, so does our enemy. We believe our fleet is better than his; he thinks his is better than ours. Both fleets are dedicated to the same end, fighting; and to do this most effectually each fleet maneuvers according to a system of tactics which each believes will give him the advantage in the death struggle about to follow. This struggle will take place at some place on the sea where the commanders-in-chief have reason to believe the theatre of war will be, having in mind the situation of their respective bases,

bases of operation, the lines of operation and the objective. Towards assembling his force for fighting, towards effecting this concentration, each commander resorts to that strategy which he believes will enable him to circumvent his opponent, and assure to him the command of the sea.

In the above brief abridgement, as well as in all that has been written before about strategy and tactics and fleets and ships, we have only attempted to repeat what has been said and known from time immemorial, namely, that a navy depends for its success, its prestige, its glory, on its officers. If our officers be the superior of other officers in knowledge, in attainments and in intellect, our navy stands to win: if not, to lose. "Finally," writes Mahan in "Sea Power," "it must be remembered that among all changes, the nature of man remains much the same; the personal equation, though uncertain in quantity and quality in the particular instance, is sure always to be found."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

"PUNISHMENT" AS APPLIED TO SOLDIERS AND SAILORS.

By Lieutenant-Colonel G. Haines,
British Imperial Service and Commandant Detention Barracks, Aldershot, England.

"Punishment" as applied to soldiers and sailors.

Such is to form the subject of the following article.

I feel that in being asked to write it a great compliment is paid to me, and I intend to try my best at the risk of disappointing my readers.

I have spent thirty-three years among soldiers, sixteen of which have been passed respectively as governor of various military prisons, and commandant of various detention barracks.

Does this entitle me to write about sailors?

Yes, I think so, and civilians too.

They all belong to the human race, and differ one from another but little as a whole.

I will, however, write of the soldier here, in the hope that my remarks may be considered applicable to all.

As my active service draws to a close I can honestly say, and with pride, that I have always looked upon the "human being" among whom my lines so far have been cast, as my friends, both when free and when undergoing so called "Punishment."

Note.—Lieutenant-Colonel G. Haines is the father of the Detention System in England. He has been connected with prison administration for about 14 years in England and India, and has had the widest experience in the handling of both criminals and the ordinary offenders against discipline in the British army and navy. He represents what might be called the advanced school of handling offenders against society, and his views coincide entirely with the progressive movement now going on in most of the large prisons in this country, both state and national, toward a more rational treatment of offenders against society.

I will divide them into two:

1. The large majority.

2. The small minority.

The large majority includes the soldier who is free and remains so throughout his service-engagement, doing his daily work, and earning his pay, board and lodgings.

He is a faithful servant.

His life is one of honest work, pride of country and its traditions, healthy exercise, good companionship and general satisfaction.

All is well with him.

The soldier of the present day is an educated man.

If he, as an educated man, behaves like a beast and remains incorrigible, he must be got rid of as a noxious weed.

His disease is infectious and apt to spread, so out he goes.

It is obvious that the soldier, to be worth the pay he draws, and the food he eats, must be kept for ever fit and eternally up to the mark.

Enter . . . "The officer," another educated man.

Professionally, his education for many years past has been on the upward grade, and has rendered him fitted to handle and teach intelligent men.

He is, undoubtedly, the individual on whom depends the efficiency of the men, and right well does he obey the call.

This is beyond all doubt.

Were it not so, the state of things I shall presently attempt to describe could not obtain.

I now make use, for the first time, of the word "crime."

It is an ugly word and means disaster.

If crime becomes in any way "chronic" . . . Cherchez L'Officier.

Prevention, by everlasting vigilance, care, and instruction, which command respect and obedience, is far better than the sudden brutal so called *cure* which so often degrades the patient and points to the inefficiency of the "practitioner."

The main factors which keep an army together are:

Patriotism.

Esprit de Corps.

Honour.

Competition.

Power and courage to endure, and to play the game.

The whole rolled into one concrete word "Discipline."

When it is said "all men are equal," "one man is as good as another," when social democracy is the order of the day; the bottom drops out of the word discipline, and inefficiency and chaos reign supreme.

If a man cannot stand a subordinate position, let him strive hard to rise.

The higher he gets, the fewer masters and more servants are above and below him respectively.

Scripture tells us that all are not equal even in Heaven, and I am inclined to think that the master and man business may be somewhat overdone in Hell.

On this planet a happy medium and a proper distribution of authority must be arrived at to make existence possible, and fitness certain.

From a company to an army corps, efficiency (i. e. absence of crime), depends on the officer.

There are few men happier than the well conducted soldier.

There are few men more miserable or demoralized than he who leaves the track and drifts into . . . .

The small minority, which is made up of men who, through stupidity, carelessness and weakness, commit offences against the book of rules, and must pay forfeit accordingly.

They must be punished.

There are two kinds of punishment.

1. Expiation.

2. Reformation.

The first was the only kind for many years.

The second came up at the call of humanity, common sense and progress.

The first is merely a vindictive and very undignified wish to "get even" with a man, which degrades the punisher and the punished.

It obviously must be useless, if not dangerous, as applied to men whose business is to safeguard their native shores.

It blots a man out, rubs him off the slate.

Men differ in temperament, character and instinct, just as they differ in age, size and appearance.

In a detention barrack they are like sick men in hospital.

You do not give a gargle to a man with a broken leg.

It is obviously futile to treat all alike.

Each man's offence or desease must be diagnosed.

It must be taken in both hands and squeezed out of him.

The object of detention as carried out in the British Army to-day is, by rigorous discipline, systematic professional and industrial training to return the erring soldier to his unit efficient in all his duties, with a serious view of the army as a patriotic wage-earning profession: and to place in his hands the knowledge of a useful trade, and so enable him, if he so desires, to give the "unemployed" list a wide berth on discharge.

Re-enter . . . The officer.

The handling of the soldier under sentence in a detention barrack is a peculiarly ticklish business.

The necessary individual treatment is truly a laborious affair.

But it is quite extraordinary how the good results outweigh the disappointments.

The "ding dong" common sense of the treatment, with the unfailing justice, sympathy and help, appeal to every kind of malefactor.

The biggest blackguard curls up under it, and the man who, speaking generally, remains totally unaffected by it, is either one who will some day, if he does not already, merit hanging: or the totally depraved, half baked, degenerate imbecile, who should be in an asylum, and not entrusted with the "safeguarding of his native shores."

In the early stages of the change from imprisonment to detention in England, grave doubts were entertained as to its ultimate success.

"A Premium on Crime" and such like names were suggested.

More recently eminent naval men said . . . "It may be all right for soldiers, but it is doubtful whether it be not too easy going for sailors," or words to that effect, but I fancy these officers have changed their minds, as the navy have taken the detention barrack methods into use.

As for the sailors, I have had charge of able seamen, stokers, cooks mates, naval ratings of all kinds, and have found them splendid men, with a big M, amenable, obedient and hardworking, in an atmosphere of justice, sympathy and assistance.

How is it done?

Again I say "Cherchez L'Officier."

In this case he stands alone.

The success of his establishment depends solely on him.

There is no chain of responsibility for him to handle.

The responsibility rests upon his shoulders only.

He must, therefore, be the right man or his life must be unbearable.

Once he has trained his staff to look through his eyes, the the thing goes of itself.

Till then he can never rest.

His best friend is the busy day.

Everything done in quick time when not at the double.

The man under sentence must be kept fully occupied in mind and body.

Make him understand that his day is spent entirely for his own physical and mental improvement.

Keep him in the open air.

Give him enough to eat.

Make his instruction interesting, and at the end of a short lecture, make him answer questions.

Do this, I say, and you will find that he, perhaps unconsciously, drinks deep of the chances given him.

Forgive me if I repeat that these men are all very much alike as a whole.

It is absurd, it is more, it is wicked to judge a man untried, and stamp him as physically and morally unfit just because his head is a certain shape, his ears stick out at right angles to his head, and he has forgotten to clean his boots.

People there are, who will tell you that he is a "type," that, either from heredity, or environment, or both, he must be an unreclaimable swine.

If this man does not rear up and break rules and furniture such people are badly disappointed: not necessarily because the man is better than they thought, but because their pet bubble has been pricked.

Low environment, I grant, is a fierce enemy to tackle, but I fancy the descendents of men who sailed for Botany Bay at the government's expense, have bust the heredity theory also.

There is a spark of good somewhere in every living man.

It only needs blowing steadily till the glow becomes a flame.

The flame soon purifies the evil mind found in a rotten body.

Penal treatment is degrading and stamps out the spark, so "blow," say I, "blow all the time."

I ask leave to state that in the British Army since the present detention methods have come into use, "chronic" crime has totally disappeared.

It is no longer intermittent.

At worst it is sporadic.

The detention barracks are nearly empty.

The ranks are, therefore, proportionately full.

The "busy day" is a strenuous affair . . . Few care for a second course: and few who have gone through it will deny that during that course, they have been brought to a normal condition of nerve, self respect, ambition and hope.

I have mentioned "competition" as one of "discipline's" ingredients . . . I will (in parenthesis) explain.

It means professional "work" and health giving "play" at their best.

It acts as a kind of automatic sorter.

It separates the "men" from the "monkeys."

It is a sieve, which lets only the sound man through, and leaves the waster, the man who falls out on the march, who cannot hit a haystack, and trembles at the word "work," for all to see.

Competition in shooting under service conditions, tests of endurance and fitness, are for ever on the carpet.

Men keep themselves fit so that they can represent in some way their sections, in the hope that some day they may have to represent their battalions.

It is the same with play; athletics, football, cross-country running, etc., etc., are carried to an extent which is disastrous to the brewers of ale.

These things call for training, and training fails under the "Wein-Weib-und-Gesang" treatment.

Well! This spirit of competition pervades the detention barrack.

There is no issue of beer.

Tobacco is prohibited.

Silence is observed strictly, and a key is turned in the lock at night.

Nevertheless, the spirit of competition is plainly apparent, and the hangdog look of the "prisoner" is nowhere to be seen.

There is nothing scientific or abstruse about this short article of mine.

It is written with a view to saving such as may have reforms in contemplation, from the drudgery of all drastic changes, from the hard mill of evolution, and to assure them that the planks I have crossed are of sound weight carrying stuff, to be crossed by all who have the welfare of their soldiers and sailors at heart, in perfect safety.

ANNUAL ENGLISH REPORT ON DETENTION BARRACKS.

WAR OFFICE, MAY 6, 1911.

TO THE ADJUTANT-GENERAL TO THE FORCES:

SIR:—I have the honour to submit the Annual Report on Military Detention Barracks and Military Prisons for 1910.

2. *Accommodation.*—Particulars of the accommodation available during the year in all the duly constituted military detention barracks and prisons at home and abroad, except India, are given in Appendices 1, 2, and 3.

3. In consequence of the continued *decrease* in the number of admissions into military detention barracks and prisons, the following establishments were closed during the year:

Curragh Military Prison.

Chatham Branch Detention Barrack.

4. All soldiers sentenced to imprisonment and discharged with ignominy for purely military offences are now committed to Woking Military Prison.

5. The accommodation at Wynberg Detention Barrack has been decreased from 71 to 48 rooms by the demolition of 23 rooms, constructed as a temporary measure during the South African War.

6. An addition of 16 rooms is now being made to Hong Kong Detention Barrack for the accommodation of naval ratings sentenced to detention.

7. The daily average population of regular soldiers in military detention and branch detention barracks and military prisons at home and abroad (excluding India) in each of the years 1904-1910 was as follows:

Year	At home	Abroad (excluding India)	Total	Proportion in 1000 of average strength of Army
1904	1140	402	1542	8.4
1905	803	359	1162	6.1
1906	641	257	898	4.7
1907	598	207	805	4.5
1908	489	166	655	3.7
1909	465	135	600	3.3
1910	379	96	475	2.7

[illegible] DISCIPLINE AND SOLDIERS

(a) The number of soldiers [illegible] military prisons under sentence of detention and imprisonment by [illegible] training officers and courts-martial was as follows:

Year	Average strength of Army at home and abroad, including Indian	Summarizing Officer's award		Courts-Martial					
1936	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1937	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1938	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1939	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1940	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1941	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1942	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(b) The number of soldiers received into civil prisons in the United Kingdom, including those from the Colonies and India, during the year, and remaining in the gaol December 31st was as follows:

Year	Received during 1940			Remaining on 31st December, 1940		
	Military courts			Military courts		
	Soldiers convicted under Army Act, section 18, of offences of an immoral, unnatural, or criminal character.	Civil courts		Soldiers convicted under Army Act, section 18, of offences of an immoral, unnatural, or criminal character	Civil courts	
1936	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1937	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1938	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1939	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1940	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1941	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1942	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* [illegible]
† [illegible]
‡ [illegible]

(c) [illegible] establishment of military detention barracks and military prisons has been made, resulting in a decrease of [illegible] of the Army Estimates.

(d) *School Instruction.*—The school instruction has been carried out with satisfactory result. Five certificates of education were obtained during the year by men undergoing detention.

(Sd.) F. N. MACREADY, *Major-General,*
Director of Personal Services.

THE DETENTION SYSTEM AND PUNISHMENTS GENERALLY.

(Excerpt from Annual Report of the Secretary of the Navy, 1911.)

In an examination recently made in England into the various features for improving the condition of the British Navy the department was much impressed with the detention system originally started in the British Army and now in use in the British Navy. In these sister services there has been for some time an absolute separation of the men being punished for offences against discipline and those convicted of crime, such as felony, fraud, or scandalous conduct. Men convicted of crime are sentenced to ordinary civil prisons, where their treatment is that given to similar offenders from civil life. All offenders against discipline in these services are punished by detention punishments, which are short and very exacting, but which do not brutalize or degrade the offender. Such men are quartered in detention barracks, with a room for each. Their meals are served to them separately, and they do not at any time converse with each other or with the noncommissioned officers in charge.

Rigid routine of drill and useful work is maintained. The forenoons are passed in military drills, the aim at Aldershot detention barracks being particularly to turn out men who have improved in military drills and marksmanship, so that they will go back to their commands and be more useful than they were before. The afternoons are spent in useful work, or in the repair of articles in general use at the large military camp at Aldershot. The men are also put through a thorough course of military training, including skillful work in the gymnasium, and as they are not allowed tobacco or other stimulants during the time they are under detention the improvement in their physical and mental welfare is most marked.

When it is considered that the period of detention will run from 10 days to 6 weeks, the efficacy of the system may be seen by the results accomplished in such a short time. No prison garb is worn; there is no harshness of tone or manner toward those under detention; and the whole purpose of the system may be said to be to restore moral tone, to improve the physical condition, and to keep every moment of the offender so occupied with rigorous and exacting drills and occupations that he is most anxious never to be punished the second time in this way. The results, as shown in an official report of the British Army, are significant in showing the reduction in the number of offenders and in the greatly reduced accommodations thus made necessary.

By the British Army act of 1906 all army prisons became detention barracks, except two. In the British Army the daily average population of all the detention barracks was, in 1906, 898 men, and in 1910 it had been reduced to 475, this result being accomplished by the detention system and the diffusion of knowledge regarding it in the ranks of the British Army. It is stated by British officers that the system has resulted in a marked decrease in disciplinary offences and crime generally. This is shown by the following figures: In 1907, one year after the system had been generally adopted by the army, 12,891 men were committed to the detention barracks for detention punishment and 286 men were committed

to prisons for criminal offences. In 1910, three years later, 8960 were committed to detention barracks and 192 to prisons. This is a marked reduction in three years.

Not only are the number of offences against discipline reduced, but naval prisons are rendered almost unnecessary, and economy results from the fact that the terms of detention are very short and the number of guards necessary is remarkably small. At the Aldershot detention barracks, where there were about three hundred men under detention at the time of my visit, there was one watchman on duty at a time at night, another watchman relieving him for half the night. During the daytime there were about a dozen noncommissioned officers present, who act as drillmasters and are in charge of men at work. The men are allotted certain tasks, and they get good marks when they improve on the work allotted to them. This feature, with perfect conduct, slightly reduces the length of time they are kept under detention. The commandant of the detention barracks at Aldershot told me that very seldom does a man come back the second time. All the men feel that they are being punished, but that it is quick and short and disagreeable, and they seem reconciled to the fact that they are paying a reasonable, if disagreeable, penalty for what they have done.

A start has been made toward inaugurating the detention system in our Navy, and I propose that the system shall be used in the present naval prisons, providing they can be changed to suit the new conditions. In England the punishment for desertion and absence without leave is by detention. No loss of civil rights accompanies such punishment. In this country an enlisted man convicted of desertion suffers the loss of all civil rights—practically the loss of his citizenship, since he can at no time afterwards hold any public office. I believe that the possibility of this punishment in time of peace should be removed, and so recommend.

In the past year the sum of about $600,000 has been taken from the pay of enlisted men in fines, inflicted by naval courts. This money goes to the naval hospital fund. The men's pay is not any too much as it is, and those convicted of absence without leave and other offences against discipline are frequently fined two weeks' or a month's pay, and frequently as much as three months' pay. For the men whose records or character indicate a possibility of reform short-term, sharp punishments should be provided, so that these men may be returned to duty chastened and better men. For those of bad record or character severe punishment should be inflicted and such men entirely separated from the service as a deterrent to others of like character. The prevention of desertion can also be aided by the prompt and certain apprehension of deserters.

REPORT OF THE INSPECTOR GENERAL OF THE U. S. ARMY, NOVEMBER 25, 1911, ON THE DETENTION BARRACKS, BRITISH ARMY.

About seven years ago, for the purpose of preventing soldiers convicted of offences against discipline under the Army act and not charged with ignominy, from being subjected to the stigma attaching to imprisonment, the Army act was amended so that courts-martial could award detention instead of imprisonment as punishment for military offences.

Under the same act commanding officers can award detention not exceeding 28 days.

Detention barracks were established as follows:

	Rooms.
Aldershot	226
Colchester	63
Devonport	40
Gosport	163
York Castle	114
Cork	102
Dublin	131
Sterling	48
Total	887

Branch detention barracks were established at—

	Rooms.
Chelsea	30
Pembroke Dock	6
Shorncliff	15
Woolwich	32
Jersey	10
Total	93

Since 1910, all soldiers sentenced to imprisonment for purely military offences are now committed to the Woking Military Prison.

The military prison at Curragh and a branch detention barracks at Chatham were closed during the year 1910, in consequence of continued decrease of the number of admissions into military prisons and detention barracks, respectively. Others were established in outlying possessions.

The Regulations of the military prison and detention barracks state:

"The chief object of establishing a prison or detention barracks for military offenders is to maintain discipline in the army and to repress the repetition of military offences; as punishment alone can hardly be expected to produce this effect, he (commandant) shall consider it his duty to endeavor to instill soldierly life and military principles into the mind of every soldier under sentence, letting him see that he takes an interest in his welfare, and by his good advice and kindly admonition endeavor to convince him of his error and to encourage him to aim at future good conduct and

the attainment of a respectable character in the service. Bearing in mind that the soldiers are, in most cases, to return to the colors on release, and that they should be fit at once to resume their places in the ranks, the commandant will pay special attention, not only to the discipline and military training of such soldiers, but also to their bearing and personal appearance."

The strictest military discipline with silence is maintained. Soldiers under sentence are not to talk or communicate with each other. By good conduct, proficiency, attention to military instruction, and industry, a soldier with a sentence of 28 days or upward may earn a remission of sentence not to exceed one-sixth of the whole sentence. To obtain a remission of one-sixth of his sentence he must earn five-sixth of the total marks obtainable during the whole of his sentence. This remission of one-sixth of the sentence is decreased proportionately with the number of times a soldier under sentence has been convicted by court-martial. For example: If convicted twice, by one-twelfth; if convicted three times by one twenty-fourth. In other words, in order to earn a remission, a soldier must earn five-sixths, eleven-twelfths, or twenty-three twenty-fourths, as the case may be, of the total number of marks obtainable during the whole of his sentence.

The total number of marks obtainable in a day is eight.

The promotion of a soldier under sentence from the lower to the higher stage is gained by industry, good conduct, and attention to his drill, but it may be postponed for idleness or misconduct; or he may be removed to the lower stage; or he may forfeit any of the privileges of his stage.

A daily record is kept of marks obtained, and to become eligible for remission, a soldier must earn the required number of marks and, in addition, any marks he may have forfeited for misconduct. He must earn 112 marks before he becomes eligible to the second stage.

A soldier under sentence in the first stage will—

(*a*) Be employed daily on hard bodily or hard manual labor for not more than 10 or less than 6 hours, exclusive of meals; (*b*) sleep without a mattress; (*c*) perform one hour's physical exercise daily; (*d*) be allowed books of religious and secular instruction; (*e*) be allowed exercise on Sunday.

A soldier under sentence in the second stage will—

(*a*) Be employed on work of a less hard description for not less than six hours daily; (*b*) sleep on a mattress every night; (*c*) perform two or three hours' drill and gymnastics daily; (*d*) be allowed books of instruction both religious and secular; (*e*) receive school instruction if eligible under the regulations made for the education of soldiers under sentence; (*f*) be allowed a library book, which may be changed twice a week; (*g*) be allowed exercise on Sunday; (*h*) be allowed to receive and write a letter, and receive a visit of 20 minutes' duration from a friend.

Marks are awarded daily by a thoroughly reliable and responsible member of the staff.

Hard labor consists of breaking stones, or such other like description of hard bodily and hard manual labor as may be appointed.

PUNISHMENTS AGAINST DISCIPLINE IN DETENTION BARRACKS.

The commandant's power is limited to—

(*a*) Close confinement to any period not exceeding 3 days; (*b*) reduction of diet as laid down in the scale of diets for ill-conducted and idle soldiers under sentence; (*c*) reduction from higher stage to lower stage, or postponement of promotion to higher stage for a period not exceeding 14 days; (*d*) deprivation of mattress for any period not exceeding 3 days for idleness or refusing to work; (*e*) forfeiture of remission of sentence for a period not exceeding 7 days.

No soldier under sentence can be put in irons or under mechanical restraint by the commandant except in case of urgent necessity, and the particulars of every such case shall be entered in the commandant's journal.

The military, educational and physical training while in detention barracks is such as to keep the trained soldier efficient and to give elementary training to untrained men.

The course of military training consists in—

(1) Drill, physical exercise, gymnastics, etc.; (2) musketry; (3) signaling (semaphore); (4) lectures on skirmishing and scouting; (5) lectures, explained on a blackboard, on outposts, advance and rear guard; (6) knotting and splicing and lashing spars, making bridges; (7) making field trenches, head cover, and loop holes.

Soldiers sentenced by courts-martial and those under four months' service or who have not fired a recruit's course of musketry, perform musketry drill daily, consisting of firing exercises, aiming, pointing, etc., and they continue to do so until they are fit to fire a course on the miniature range.

Trained soldiers perform one hour's musketry drill at least once a week.

Soldiers under sentence who have been discharged from the army, or who are to be discharged therefrom upon release, will not be practiced in drill or gymnastics or any military training, but are kept at hard work instead.

Soldiers who are under punishment for offences committed in the detention barracks are likewise ineligible for drill, gymnastics, or military training.

Soldiers in detention barracks, in addition to this military training daily, are employed on productive and useful work for the military departments, such as making kit bags, nose bags, stable and linen bags, mattress cases, bed cases, bolster cases, mats of various kinds, head and heel ropes, coal sacks, repairing clothing, bed linen, and equipments of various kinds, remaking beds, bolsters and mattresses, painting kit boxes, buckets, etc., washing bed and bolster cases, hospital kits, clothing and personal linen of soldiers under sentence, cleaning and laquering harness and saddlery and ordnance stores of all descriptions, chopping and bundling kindling wood.

The washing of barrack bedding of all the troops in the London district is now done at the Woking Military prison.

Specially selected noncommissioned officers are appointed for duty in the detention barracks on probation for four weeks; if not found suitable, they are reurned to their corps.

Religious instruction is given by chaplains to those who are willing to receive it. All soldiers under sentence are required to attend divine service on Sunday, and on other days when such service is performed. A chaplain is required to see each soldier separately, occasionally.

School instruction is given to all soldiers under sentence in the second stage who have sentences exceeding 21 days. Such instruction is given between 4 and 8 p. m., and care is taken that the drill is not interfered with, and that the minimum of 6 hours' work is performed by each soldier on every week day.

DAILY ROUTINE.

WEEK DAYS.

5.30 a. m.—Reveille; clean up and prepare for kit inspection.
6.05 a. m.—Check roll call; slops collected; rooms and halls swept; sick list made out.
6.20 a. m.—Kit and room inspected; tasks checked.
6.40 a. m.—Work begins; second stage parade for drill; physical or military training in hot weather.
7.45 a. m.—Breakfast.
8.15 a. m.—Clean equipments, rooms, etc.
8.50 a. m.—"Closeting" removed.
9.15 a. m.—Second stage parade for inspection in marching order for drill and musketry; first stage parade for inspection in marching order and proceed to physical training for one hour.
10.30 a. m.—Second stage gymnastics; first stage recommence work.
11.30 a. m.—Second stage recommence work.
12.30 p. m.—Dinner.
1 p. m.—Clean kit, rooms, and equipment.
1.15 p. m.—All recommence work in rooms.
2.15 p. m.—Second stage parade for physical training or military training (in hot weather work recommences); first stage continue work.
3.15 p. m.—Second stage recommence work.
4.15 p. m.—School for second stage.
5.45 p. m.—School and work cease.
5.50 p. m.—Supper.
6.15 p. m.—Work recommences in room.
8 p. m.—Work ceases; lock up.
9 p. m.—Lights out.

SUNDAYS.

6.30 a. m.—Reveille.
7.45 a. m.—Breakfast.
10.15 a. m.—Divine service.
12.30 p. m.—Dinner.
5.50 p. m.—Supper; lock up.
9. p. m.—Lights out.

SCALE OF PARADES.

MONDAY.

9.15 to 10.15 a. m.—Marching order one hour; route marching carried out.

10.20 to 11.20 a. m.—Physical training, signal exercise, and lecture. Men with sentences of 14 days and under, physical training outside of gymnasium.

11.25 a. m. to 12.15 p. m.—Physical training, gymnasium, signaling and lecture. Men with sentences of 14 days and under, signaling.

1.45 p. m.—Men proceed to work; school instruction.

TUESDAY.

9.15 to 10.15 a. m.—Marching order one hour; company and squad drill.

10.20 to 11.20 a. m.—Physical training, gymnasium; knotting and bridging. Men with sentences of 14 days and under, physical training outside of gymnasium.

11.25 a. m. to 12.15 p. m.—Physical training; knotting and bridging. Men with sentences of 14 days and under, signal drill.

11.45 a. m. to 12.15 p. m.—Men outside of established church proceed to chapel.

1.45 p. m.—Men proceed to work; school instruction.

WEDNESDAY.

9.15 to 10.15 a. m.—All men parade in skeleton marching order for musketry instruction.

10.20 to 11.20 a. m.—Physical training classes, gymnasium; knotting and bridging. Men with sentences of 14 days and under, physical training outside of gymnasium.

11.25 a. m. to 12.15 p. m.—Physical training in gymnasium; knotting and bridging. Men with sentences of 14 days and under, signal drill.

11.45 a. m. to 12.15 p. m.—Men of the established religion to chapel.

1.45 p. m.—Men proceed to work; school instruction.

THURSDAY.

9.15 to 10.15 a. m.—Marching order one hour; squad and section drill; skirmishing.

10.20 to 11.20 a. m.—Physical training, gymnasium; signal drill; lecture and tent pitching. Men with sentences of 14 days and under, physical training outside of gymnasium.

11.25 to 12.15 p. m.—Physical training, gymnasium; signal drill; lecture and tent pitching. Men with sentences of 14 days and under, signal drill.

1.45 p. m.—Men proceed to work; school instruction.

FRIDAY.

9.15 to 10.15 a. m.—Marching order one hour; company and squad drill.

10.20 to 11.20 a. m.—Physical training, gymnasium; signal drill and lecture. Men with sentences of 14 days and under, physical training outside of gymnasium.

11.25 a. m. to 12.15 p. m.—Physical training, gymnasium; signal drill; lecture. Men with sentences of 14 days and under, signal drill.

1.45 p. m.—Men proceed to work; school instruction.

SATURDAY.

9.30 a. m.—Commandant's inspection of barracks; men exercise and then proceed to work.

SUNDAY.

10 a. m.—Men of established religion parade for divine service.

9 a. m.—Roman Catholics, same. Men of other religions as ordered.

Exercise for one-half hour in morning and one-half hour in afternoon.

(1) Route marching is carried out at rate of 4 miles an hour.

(2) Men are put in squads for musketry instruction according to their qualifications and their units.

(3) The daily musketry squad is selected as required and includes the standard tests.

(4) Men with sentences of 14 days and under who are proficient in signaling join an advanced class from 11.25 a. m. to 12.15 p. m.

(5) A special squad is formed as required for untrained men, namely recruits, special reserve men, etc. Deserters for a long period also join this squad until considered fit to join the trained one.

(6) Men who have fired a course in detention barracks may be advanced to the trained soldiers' squad when considered fit by the commandant.

(7) Men are advanced to higher classes by order of the commandant. Periodical kit inspections are made by the commandant for parade.

DIETARY (TABLE FARE).

[For sentences of 7 days or under.]

Breakfast.—Daily: Bread, 8 ounces; gruel, 1 pint.

Dinner.—Sunday and Wednesday: Bread, 8 ounces; suet pudding, 8 ounces. Monday and Friday: Bread, 8 ounces; potatoes, 8 ounces. Tuesday, Thursday, and Saturday: Bread, 8 ounces; porridge, 1 pint.

Supper.—Daily: Bread, 8 ounces; gruel, 1 pint.

[Sentences of more than 7 days and not over 42 days.]

Breakfast.—Daily: Bread, 8 ounces; gruel, 1 pint.

Dinner.—Sunday: Bread, 4 ounces; potatoes, 1 pound; suet pudding, 1 pound. Wednesday: Bread, 4 ounces; potatoes, 1 pound; soup (pork and beans), 1 pint. Monday and Friday: Bread, 4 ounces; potatoes, 1 pound; beef or mutton with bone, 8 ounces. Tuesday, Thursday, and Saturday: Bread, 8 ounces; potatoes, one-half pound; soup, 1 pint; cheese, 2 ounces.

Supper.—Daily: Bread, 6 ounces; gruel, 1 pint.

[Sentences for more than 42 days.]

Breakfast.—Daily: Bread, 10 ounces; gruel, three-fourths pint.

Dinner.—Sunday: Bread, 5 ounces; potatoes, 1 pound; suet pudding, 1 pound. Wednesday: Bread, 5 ounces; potatoes, 1 pound; soup (pork and beans), 1 pint; cheese, 2 ounces. Monday and Friday: Bread, 5 ounces; potatoes, 1 pound; beef with bone, 9 ounces. Thursday: Bread,

5 ounces; mutton with bone, 9 ounces; potatoes, 1 pound. Tuesday and Saturday: Bread, 5 ounces; potatoes, 1 pound; soup, 1 pint; cheese, 2 ounces.

Supper.—Daily: Bread, 9 ounces; gruel, 1 pint.

[For badly behaved and idle soldiers.]

No. 1.—1 pound of bread per day, and water.

No. 2. (Stirabout).—Breakfast: Bread, 8 ounces. Dinner: 1 pint stirabout (2 ounces oatmeal, 2 ounces Indian meal, and salt); potatoes, 8 ounces. Supper: Bread, 8 ounces.

The control and general management of the detention barracks and military prisons are under the army council. All orders in connection with inspections, discipline, interior economy, and military training are issued through the director of personal services.

The detention barracks are under the charge of a commandant, generally a field officer, but are under the command of a general, or other officer, commanding the district or station within which the barrack is located, and who inspects the detention barrack from time to time.

An officer, not below the rank of a field officer, is detailed weekly by the general officer (or officer) commanding, as detention-barrack visitor. There is also a board of visitors detailed, that visits the detention barrack at the end of each half year.

I visited the detention barracks at Aldershot on October 13, 1911. This barrack is under the charge of Lieut.-Col. G. Haines, an officer evidently well adapted to the work and who has given many years to it. He stated that the scheme has received the approval of the service and that, with rare exceptions, the soldiers were returned to their regiments good and useful men; that he had received letters from regimental commanders expressing their surprise at what had been accomplished by men sent from their regiments in the way of target instruction. The only change that Col. Haines would suggest in the present scheme was that the punishment awarded first offence of desertion should be at least six months. The sentence now awarded is 28 days for the first offence.

Lieut.-Col. R. A. Henderson, who was inspector general of military prisons and detention barracks in 1906, reported that: "The daily average of soldiers under sentence has decreased about 29 per cent, due to the high state of efficiency and discipline in prisons and detention barracks; to which cause, in addition to the present system of military punishment, the decrease of soldiers under sentence is, in my opinion, in no small degree to be attributed."

The result of the system seems to be to reduce the number of hardened cases to such an extent that it is found best to discharge them from the service rather than to permit them to spread discontent among the soldiers. A large proportion of hard cases are manufactured in prison, and many a man comes out of prison much worse than when he went in. The detention system has the opposite effect, and it is found better to get rid of men who cannot be softened or reformed.

It took five or six years for the detention system in England to establish itself, but it apparently has saved many men from trouble and from degen-

erating into hardened cases. They evidently endeavor in this system to apply humane common sense in the treatment of men in trouble. This gives an opportunity for the men to recover their self respect and respond to any patriotic instinct which, under the stigma of prison life and its demoralizing environment, can not be expected to survive.

The commandant at Aldershot states that he finds a distinct feeling of self respect within the walls of his establishment. This is apparent, in his opinion, from the fact that he observes a keenness to give satisfaction, and to put up a good show when visitors come around, and that the sulky, hang-dog look of the prison is not to be found. This was apparent at the time of my visit.

The commandant states that one sojourn in the detention barracks is generally sufficient, if long enough, to make the soldier useful to his unit. Very few ever return to the detention barrack. He also reported to have known several cases of men being promoted noncommissioned officers for efficiency obtained in the detention barracks.

I was very much impressed with this system as observed at Aldershot.

Soldiers sent to the detention barracks retain their uniform and keep their entire kit, except the rifle, in their rooms. The rifles are issued to them when they turn out for parade. There is no mark or insignia to indicate any idea of imprisonment. The man remains a soldier and is treated as such except that his freedom is restricted and he is detained within specified limits. The effort is to remove the cause for the failure of the man to meet the requirements of the service, to build him up physically so that his nervous system will be in order to respond to the character of instruction and treatment he receives while in these barracks. The majority of the men who come here are sentenced for offences that seem to have their origin in the excessive use of alcoholic liquor, inordinate use of cigarettes, and other indulgences which overtax and wreck the nerves. The effort is to build up the nervous system. For this reason, soldiers detained in these barracks are not allowed to use tobacco at all.

The barrack at Aldershot is located within an inclosure surrounded by a high wall. The barrack is of plain, substantial construction, three stories high, with a central passage extending to the roof, upon which three tiers of rooms open. Each man has a separate room. No conversation is allowed at any time except when it is absolutely necessary in the performance of duty or work.

I saw the men at drill and at work in the shops and in the gymnasium. The work in the gymnasium was excellent and carried on under a gymnastic instructor.

The devices in the yard for target practice were excellent and constructed in a systematic way by means of diagram, etc., on a scale to appear at the short ranges employed as they would appear at the full range, miniature moving targets being used for actual firing.

The fundamental idea controlling the scheme seems to be: Keep the soldier sentenced to the detention barracks employed in useful work, the use of the rifle being very prominent in the scheme.

It will be observed that the "diet" and "separation" play an important part in the scheme of treating soldiers in these detention barracks.

E. A. GARLINGTON, *Inspector General.*

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE AMERICAN NAVY IN THE ORIENT IN RECENT YEARS.

By CHARLES OSCAR PAULLIN.

III.

THE SPANISH-AMERICAN WAR IN THE PHILIPPINE ISLANDS, 1898.

Until 1898 the duties of the Asiatic squadron were chiefly such as fall to ships of war in foreign ports during periods of peace. The squadron was employed in protecting American citizens, redressing injuries inflicted upon them, negotiating treaties, extending our commercial privileges, and exchanging social courtesies with foreign governments. It is true that in prosecuting these employments skirmishes with the natives occurred now and then, and a few of our men were killed or wounded. Our relations, however, with the peoples of the Orient were for many years uniformly peaceful. Suddenly, on the outbreak of the Spanish-American War, this state of affairs was changed, and the Asiatic squadron was ordered to fight and conquer the Spaniards in the Philippine Islands.

In the fall of 1897 the Navy Department chose a successor to Rear Admiral Frederick V. McNair, the commander-in-chief of the Asiatic squadron, whose tour of sea duty was about to expire. From a list of three officers of high rank, it selected Commodore George Dewey, who had been serving as president of the board of inspection and survey.[1] The new commander-in-chief was sixty years of age, forty-three of which he had spent in the navy. Entering the naval academy in 1854, he four years later graduated fifth in a class of fifteen. During the Civil War he saw much service under Farragut and other commanders of the blockading squadrons, and participated in the capture of New Orleans

[1] Long, John D The New American Navy, i, 176-178.

and Fort Fisher. After the war he filled various stations at sea and on shore. In 1889 he was made chief of the bureau of equipment and recruiting, in 1893 a member of the lighthouse board, and in 1895 president of the board of inspection and survey. He received a commodore's commission in 1896. While his career in the navy had been highly creditable, it had scarcely foreshadowed its brilliant consummation at Manila Bay.

Dewey's orders from the department were dated October 21, 1897, and directed him to proceed to Nagasaki and relieve Rear Admiral McNair. Before he sailed from San Francisco for his station, he had collected considerable information respecting the Spanish forces in the Philippines, the policy of the administration had been outlined to him, and he had been instructed respecting his course of action in case of war with Spain.[2] On Christmas day he arrived at Yokohama, and a week later at Nagasaki, where on January 3, 1898, he relieved Rear Admiral McNair. A fortnight thereafter he returned to Yokohama, on his flagship, the protected cruiser *Olympia*, Captain C. V. Gridley, and thence went to Tokio where he was received by the emperor and empress of Japan. On February 11, he sailed for Hong Kong. Of his personal staff, he had already chosen Lieutenant Thomas M. Brumby to be flag lieutenant, and Ensign Harry H. Caldwell to be flag secretary. His chief of staff, Commander Benjamin P. Lamberton, did not arrive on the station until April.

While the possibility of a war with Spain began to influence the action of the department respecting the Asiatic squadron as early as the fall of 1897, it was regarded as more or less remote until the blowing up of the *Maine*, in the harbor of Havana, on the evening of February 15, 1898. Ten days after that catastrophe Assistant Secretary of the Navy Theodore Roosevelt directed Dewey to concentrate his squadron at Hong Kong, to retain the *Olympia*, which had been ordered home, and to keep all the ships of the squadron coaled to their full capacity. "In the declaration of war Spain," Roosevelt cabled, "your duty will be to see that the Spanish squadron does not leave the Asiatic coast, and then offensive operations in Philippine Islands."[3]

[2] Long, John D. The New American Navy, i, 178.

[3] Annual Reports of the Navy Department for the year 1898, Appendix to the Report of the Chief of the Bureau of Navigation, p. 65. This publication will be hereafter referred to as "Reports."

Dewey had a little more than two months in which to prepare for war. The flagship *Olympia*, protected cruiser *Raleigh*, Captain Joseph B. Coghlan, and gunboat *Petrel*, Commander E. P. Wood, were already at Hong Kong. The protected cruiser *Boston*, Captain Frank Wildes, and gunboat *Concord*, Commander Asa Walker, were at Chemulpo, Korea. They were ordered to proceed with all dispatch to Hong Kong. They sailed on the morning of February 28, and so well did they obey orders that by midnight of March 3 they had arrived at their destination. The *Monocacy*, a paddle-wheel steamer of the date of the Civil War, was at Shanghai. Being practically worthless, she was left there, and a part of her officers and crew were detached to fill vacancies on the other ships.

By reason of the prompt efforts of the department to increase the squadron, two other vessels shortly joined it. On April 17 the revenue cutter *McCulloch*, Captain Daniel B. Hodgsdon, arrived at Hong Kong from Singapore, and five days later the protected cruiser *Baltimore*, Captain N. M. Dyer, arrived from Honolulu, bringing a much needed supply of ammunition. Early in March the department had dispatched the old wooden corvette *Mohican* from San Francisco to Honolulu with a load of powder and shells, and she had transferred her cargo to the *Baltimore*. On April 6 Dewey purchased the British freight steamer *Nanshan* together with her cargo of coal, amounting to three thousand tons; and a little later he bought the British passenger steamer *Zafiro*, loading her with a three months' supply of provisions. He also bought another shipload of coal and filled up the bunkers of his vessels, stowing on board the *Zafiro* what was left. In the meantime, the steam machinery of the fleet had been overhauled, the hulls cleaned, and the ships painted a dark slate color, the war dress of the American Navy.

By no means all of Dewey's time was employed in perfecting and strengthening the material of his squadron. In coöperation with his commanders he made a careful study of the military situation in the Philippines, discussed plans of operations, and collected all available information respecting the strength and position of the Spanish fleet and the location of forts and mines. The information regarding the defenses of Subic and Manila bays that he was able to obtain was much less detailed and definite than he wished. He, however, felt confident of victory, as may be seen

from the following extract taken from a letter to his sister, dated April 18, 1898: "We are still waiting for the declaration of war to begin our work here. I have seven men-of-war all ready for action, and should war be the word I believe we will make short work of the Spanish reign in the Philippines. The insurgents are ready to rise at our first gun, and long before this reaches you we may be masters at Manila and other Philippine cities. . . I believe I am not over-confident in saying that with the force under my command, I could enter the bay of Manila, capture or destroy the Spanish squadron and reduce the defenses in one day."[4]

On the morning of April 25 the expected orders from Secretary Long arrived. They were clear, concise, and to the point: "War has commenced between the United States and Spain. Proceed at once to Philippine Islands. Commence operations at once, particularly against the Spanish fleet. You must capture vessels or destroy. Use utmost endeavors."[5]

Already, on the 24th, the governor of Hong Kong had informed the commodore that war existed between the United States and Spain; and, in conformity to the laws of neutrality, had requested him to withdraw his squadron from British waters within twenty-four hours. At two o'clock in the afternoon, the *Boston*, *Concord*, *Petrel*, *McCulloch*, *Nanshan* and *Zafiro* steamed out of Hong Kong harbor, and in the forenoon of the 25th were followed by the *Olympia*, *Baltimore* and *Raleigh*. As the last division left port, with its bands playing the Star Spangled Banner, it was saluted by the ringing cheers of the British soldiers and sailors stationed at Hong Kong, who were aware of the mission upon which the fleet was bound. The vessels were assembled at Mirs Bay, thirty miles distant, in Chinese waters. Here the commodore anxiously awaited the arrival of some machinery for the *Raleigh*, and our consul to Manila, Mr. Oscar F. Williams, who had left Manila on the 23d, after having been repeatedly requested to do so by Dewey. The interval of delay was spent in drilling the seamen and preparing the ships for action by removing from them spars, chests, hatch-covers and other wooden articles.

While the squadron was anchored in Mirs Bay, the first act of war in the Philippines occurred. On April 26, near Iloilo, the

[4] Army and Navy Journal (New York), xxxv, 796; Dewey, A. M., The Life and Letters of Admiral Dewey, 197-198.

[5] Proceedings of the U. S. Naval Institute, xxvi, 491; Reports, 67.

Spaniards captured the American merchant bark *Saranac*, laden with a cargo of Australian coal. Fortunately she was equipped with papers showing a transfer to the British flag, and she was released by the local authorities. The seizure of the *Saranac* was the only attempt made in the Philippines to capture a mercantile prize during the war.[6]

About noon of the 27th a tug from Hong Kong arrived at Mirs Bay with Consul Williams and the *Raleigh's* machinery. A council was immediately held on board the flagship by Dewey and his commanders, being attended by Williams, who brought word that he had left the Spanish squadron in Manila Bay. He gave the commodore all the information that he had been able to gather respecting the defenses of the bay and city of Manila. At 2 p. m. the *Olympia* displayed the signal: "All ships prepare to leave anchorage." They were off promptly on the minute, the flagship leading, and her band playing the inspiring strains of the El Capitan march. The squadron sailed in two parallel lines, the *Olympia, Baltimore, Raleigh, Petrel, Concord* and *Boston* forming one, in the order given; and the *McCulloch, Nanshan* and *Zafiro*, the other. That coal might be economized, it moved at the slow rate of eight knots an hour, to the great annoyance of the sailors who were eager for the fray.

As the ships filed out of Mirs Bay, grim in their dull war-dress, the heart of every man on board of them must have been quickened by the certainty that the cruise would be rich in adventure and dramatic achievement, by the mystery that shrouded its movements, and by a realization of the importance of its mission. In retrospect, we are likely to think that the Spanish fleet was foredoomed to destruction, but such was not necessarily the case. Supported by the land defenses of Manila and well fought, it was abundantly able to give a good account of itself. Nor must one overlook the weak points in Dewey's military situation: seven thousand miles from the nearest home port; no base of supplies except that afforded by two small steamers; a squadron of only six fighting ships and three auxiliaries, the largest of less than six thousand tons, all unarmored; the likelihood of encountering mines on entering a harbor in the Philippines; and the absence of friendly ports to which to retire in case of defeat.[7]

[6] Proceedings of the U. S. Naval Institute, xxv, 268.
[7] Massachusetts Military Historical Society Papers, xii, 373.

During the voyage to Manila Bay, which body of water lies some six hundred miles southeast of Hong Kong, the ships were made ready for battle. All of them were built before the use of wood on warships had been universally condemned. It was therefore found necessary to remove, as far as possible, their wooden fixtures. Bulkheads, ceilings, wainscotings, bunks, furniture and storage chests were thrown overboard. Spare chain cables were wrapped around the vital parts of important mechanisms for protection. Boats, spars, and booms were securely lashed. Hose were connected with the fire plugs and laid along the deck. The guns were loaded, and a supply of ammunition was brought up from the magazines. The men were drilled at their various stations, and numerous other preparations for battle were made.

At dawn on April 30, Cape Bolinao, a headland of Luzon, was sighted, and all that day the squadron sailed southward down the beautiful coast of the island. Early in the morning Dewey signalled the *Boston* and *Concord* to proceed at full speed and explore Subic Bay, some thirty miles north of Manila Bay; and later he dispatched the *Baltimore* to assist them. Before the squadron left Mirs Bay, it was rumored that the Spanish admiral, Montojo, would make his stand in Subic Bay; and the admiral had actually assembled his ships there, but regarding the situation as untenable, he on April 29 returned with them to Manila Bay.

At five o'clock in the afternoon the commodore reached Subic Bay, and was joined by the *Boston, Concord* and *Baltimore,* which ships reported that the Spanish fleet could not be found. While making a reconnaissance of the bay, the *Baltimore* overhauled a Spanish schooner and brought her to by firing a shot across her bow. She was shortly boarded by a boarding party, who returned to the *Baltimore* with her skipper and four men. As the Spaniards did not know that war existed, they and their vessel were released. About sunset, after the squadron had resumed its voyage down the coast, Dewey held a council with his commanders and announced his intention of entering Manila Bay that night.

The entrance to Manila Bay is about eleven miles wide, and is divided into two channels by the island of Corregidor. The north channel is called Boca Chica, and the south Boca Grande. The latter is divided into three divisions by Caballo Island, one mile south of Corregidor Island, and by El Fraile Rock, three miles and

a half south of Caballo Island. Dewey decided to enter by way of the southern channel and to pass between Caballo Island and El Fraile Rock, about a mile from the rock. This passage was defended by three guns on Caballo Island, a like number on El Fraile Rock, a like number on the southern mainland, and probably by some mines. No single decision of Dewey showed greater daring and completer self-possession than that to disregard the Spanish defenses and enter the bay at whatever cost. Doubtless he recalled his Civil War experiences with Farragut when the American fleet ran past Forts Jackson and St. Philip on the lower Mississippi.

The night of April 30 was perfect for the proposed undertaking. A young moon, which would set a little after twelve o'clock gave sufficient light to disclose the entrance to the bay.* The fleet approached the Boca Grande in single column, the *Olympia* in the lead. No exposed lights were permitted on any of the ships. At the stern of each vessel, however, there was a hooded light, which served to guide the ship in the rear. About 11 p. m. all hands were called to quarters, and a little later the *Olympia,* followed silently by her consorts, bent her course to enter the Boca Grande. Half the squadron had passed El Fraile Rock before the negligent Spaniards realized the situation. Presently the stern lights of the receding vessels, or else a funnel fire which flamed up on the *McCulloch,* gave the alarm, and the battery on El Fraile Rock opened fire on the fleet, which was returned by the *Boston, McCulloch, Raleigh* and *Concord,* each vessel firing some two or three shots. No injury was done to the Americans, and probably none to the Spaniards. By half past twelve a. m. of May 1—Sunday morning—the entire fleet was within the bay and slowly steaming toward Manila, thirty miles distant. The men were now permitted to lie down at their quarters, and get a little sleep if they could, and about four o'clock hot coffee was served to them. As day dawned the city of Manila with its frowning battlements was descried directly in front of the squadron, three miles away.

Dewey had expected the Spanish to make their defense under the guns of Manila. Fortunately for him, they chose a far weaker position at Cavite, nine miles from the capital, where there was a naval arsenal and several shore batteries. The adoption of these faulty tactics by the enemy was a result of his deter-

* Proceedings of the U. S. Naval Institute, xxvi, 498.

mination to save Manila from bombardment. Disappointed at not discovering the Spanish fleet at the capital, Dewey swung round to the southward and headed toward Cavite. Already the batteries at Manila had opened fire on him, but they did no damage. Only the *Boston* and *Concord* replied. As day dawned Montojo's fleet was dimly discerned in the distance anchored in an almost direct east and west line off Cavite, across the mouth of Cañacao Bay, and to the east of the peninsula on which Cavite is situated. The left of Montojo's line was not far from Sangley Point at the head of the peninsula, where two guns were mounted. A mile southwest of Sangley Point, at Cañacao, there was a battery of one gun, and at Cavite there were three guns. Montojo's fleet contained the following vessels: the *Reina Cristina* (flagship), *Castilla, Isla de Cuba, Isla de Luzon, Marques del Duero, Don Antonio de Ulloa* and *Don Juan de Austria*.[8]

About the time Manila was sighted the *Olympia* signalled to her consorts "Prepare for general action"; then a little later, "Form in single column"; and then, "Close up." Already the *McCulloch, Nanshan,* and *Zafiro* had been detached and ordered to take a position somewhat remote from the scene of battle. The six fighting ships approached Cavite in the following order: *Olympia, Baltimore, Raleigh, Petrel, Concord,* and *Boston.* The commodore and his staff stood upon the bridge of the *Olympia.* While advancing to the attack, two mines exploded some distance ahead of the flagship, too far away to do any damage. Long before the fleet was within range, the battery on Sangley Point began firing, and a little later Montojo ordered his ships to open fire. About 5.40 a. m. Dewey answered the Spanish guns, at a distance of about five thousand yards. The battle then became general, and continued almost two hours. The American squadron passed down in front of the Spanish line, turned, and passed up; and then repeated this movement, firing alternately the port and starboard broadsides. At each turn it drew nearer the enemy, until finally it was within two thousand yards of him. Five times it sailed along his line. At the outset the firing of the American ships was inaccurate, but it steadily improved. The firing of the enemy was remarkably bad throughout the fight, his projectiles either falling short or passing over the vessels of his adversary.

Early in the action two launches put out from shore toward the

[8] Reports, 90.

Olympia, apparently with the intention of firing torpedoes. One of these the Americans sank, and the other they disabled and beached.[10] Montojo's flagship was a particular target for the American guns, and she was one of the first of his vessels to be struck. Soon after the fight began a shell exploded in her forecastle, killing and wounding several men and splintering her foremast. Shortly, another shell set fire to the crews' bags on the orlop deck. A third shell completely disabled her steering gear. Then the stern of the vessel was struck and nine men put out of action. Next the mizzenmast fell bringing down the flag and ensign. A shell exploded in the officers' cabin, covering the hospital that had been established there with blood and killing the wounded seamen. A second shell exploded in the ammunition room, which was set on fire, and still another shell exploded on deck setting fire to the ship at that point. Montojo fought his vessel until she was ablaze from stem to stern. During the action he stood upon the bridge, cool and self-contained. Finally he was compelled to abandon the *Reina Cristina*.[11] "The ship being out of control," he wrote, "the hull, smoke pipe, and mast riddled with shot or confused with the cries of the wounded; half of her crew out of action, among whom were seven officers, I gave the order to sink and abandon the ship before the magazine should explode, making signal at the same time to the *Cuba* and *Luzon* to assist in saving the rest of the crew, which they did, aided by others from the *Duero* and the arsenal. I abandoned the *Cristina*, directing beforehand to secure her flag, and accompanied by my staff, and with great sorrow, I hoisted my flag on the cruiser *Isla de Cuba*. After having saved many men from the unfortunate vessel, one shell destroyed her heroic commander, Don Luis Cadarso, who was directing the rescue."[12] The *Reina Cristina* lost one hundred and thirty men killed and ninety wounded, one-half her crew; among the former were seven officers, including her captain. She was finally sunk and abandoned by the Spaniards.

Next to the flagship, the *Castilla* received the hottest fire. She was gallantly fought, and after all her guns except one had been

[10] Reports, 70. For differences of opinion respecting these boats see H. W. Wilson's, The Downfall of Spain, 134.

[11] Dewey, A. M. The Life and Letters of Admiral Dewey, 428.

[12] Reports, 91-92.

put out of action, that one was still served by her crew. Finally having been riddled with shot and set on fire, she too was sunk and abandoned. Her casualties were twenty-three killed and eighty wounded, one of her officers being among the former. The *Don Juan de Austria* was much damaged and was set on fire; the *Isla de Luzon* had three guns dismounted; and the *Marques del Duero* received severe injuries.

At 7.35 a. m., having been informed that only fifteen rounds a gun for the 5-inch rapid-fire batteries of the flagship remained, Dewey ordered the vessels to cease firing and withdraw from the action, intending to redistribute the ammunition and confer with his commanders. When he gave this order he was not aware that his fleet had practically escaped injury and that the major part of the Spanish fleet had been virtually rendered useless for further fighting. On the withdrawal of Dewey, Montojo ordered his vessels to retire into the inner harbor of Cavite, behind the arsenal and there resist to the last, and to be sunk rather than surrender.

During the engagement, the batteries at Manila kept up a continuous fire, although too far away to do any damage to the American ships. Dewey now sent a messenger to the governor-general to inform him that unless the fire ceased the city should be shelled. This had the desired effect, and the batteries were immediately silenced. On conferring with his commanders, Dewey learned that the information respecting the rapid expenditure of ammunition was erroneous. He therefore, after breakfasting his crews, ordered the squadron to return to the attack.

This time the ships approached the enemy from the south-southwest, steaming toward the batteries on Sangley Point. The *Baltimore* was in the lead, and was followed, in order, by the *Olympia, Raleigh, Boston, Concord,* and *Petrel.*[12] Only the shore batteries, and the ship *Don Antonio de Ulloa* which lay inside Sangley Point were in condition to participate in the second engagement. The *Reina Cristina* and *Castilla* were burning in the outer harbor of Cavite. The *Don Juan de Austria, Isla de Cuba, Isla de Luzon,* and *Marques del Duero,* together with several other vessels, were in the inner harbor behind the Cavite arsenal. The second fight began about 11 a. m. and continued until 12.30 p. m.

[12] The Century Magazine (New York), lvi, 616.

When the order to renew the battle was given by Dewey, the *Baltimore*, happening at the time to be chasing a British merchant ship, was two miles nearer the enemy than the other ships of the squadron, and was therefore able to engage him first. Taking a position twenty-eight hundred yards off Sangley Point she opened fire with her starboard broadside upon the shore batteries and the *Don Antonio de Ulloa*. Going dead slow, she gradually reduced her distance to twenty-two hundred yards, and having obtained the range stopped her engines. She inflicted much damage before the rest of the ships came to her assistance. The batteries were speedily silenced and the *Ulloa*, having received several shots on the water line, went down, her flag flying, the survivors of her crew escaping to the shore. Her loss was eight men killed and ten wounded, her captain and two other officers being among the former.[14]

Early in the fight the *Concord* was sent around Sangley Point to destroy the *Isla de Mindanao*, a transport. Arriving within twenty-five hundred yards of that vessel, she opened fire, and the crew abandoned their ship almost immediately. Soon the *Mindanao* was a mass of flames. In the meantime the *Petrel* had entered the outer bay and had begun firing on the ships in the inner harbor, whose masts were visible above the government buildings at Cavite. She had fired only two or three shots when the Spanish flag on the arsenal sheers was hauled down, and a white flag, a sign of surrender, was run up. The *Petrel* at once signalled the news to Dewey, who on receiving it ordered his ships to cease firing. The second engagement came to an end with this order.

Already Montojo had directed the vessels in the inner harbor to be sunk. "There remained," he said, "the last recourse to sink our vessels, and we accomplished this operation, taking care to save the flag, the distinguishing pennant, the money in the safe, the portable arms, the breech plugs of the guns, and the signal codes. After which I went with my staff to the Convent of Santo Domingo de Cavite to be cured of a wound received in the left leg, and to telegraph a brief report of the action."[15]

[14] According to the Spanish account the *Ulloa* was sunk in the first engagement. See Reports, 73, 75, 92.

[15] Reports, 92.

When a party of men from the *Petrel*, under orders to burn the Spanish fleet, arrived in the inner harbor, it found the *Isla de Cuba, Isla de Luzon* and *Don Juan de Austria* aground and full of water. It set fire to these ships and to the *Marques del Duero* and *General Lezo*. A second party burned the *Velasco*. A third party brought off the two tugboats *Rapido* and *Hercules* and three launches.[18] The hydrographic survey vessel *Argos* was also burned. The coast survey ship *Manila*, on the request of some Spanish officers, was spared. At 5.20 p. m. the *Petrel* got under way to join the flagship. By the evening of May 1, the squadron, having literally complied with its orders to capture the Spanish vessels or destroy them, had completed its work and lay at anchor off Manila.

The total loss on board the Spanish fleet was one hundred and sixty-one men killed and two hundred and ten wounded. Among the killed were eleven officers. Admiral Montojo was wounded in the leg. Six men were killed and four wounded in the shore batteries. The total loss of the fleet, three hundred and seventy-one men, was one-fourth the number engaged, almost if not quite the heaviest loss ever inflicted in a squadron action. Not a man was killed on board the American ships, and only nine wounded, and those but slightly.

The Spanish lost twelve vessels sunk and burned, and two captured; and they had three shore batteries silenced. The Americans lost not a vessel. So bad was the marksmanship of the enemy that Dewey's fleet was in practically as good fighting trim at the end of the battle as at the beginning. The *Concord* had not been hit, and the *Raleigh* and *Petrel* but once each. The *Boston* was hit four times, and the *Olympia* a half dozen or more times. The *Baltimore* received most injury, being struck by five shots. A ventilator, a gun, a bunker, and the exhaust pipe of her starboard blower were damaged. One shot, the first that struck the vessel, exploded some ammunition, slightly injuring two officers and six men—almost the only casualties on board the fleet.

The unequal damage inflicted by the two squadrons is in large part ascribable to the poor marksmanship of the enemy and to the superiority of the American fleet, which had the advantage over its antagonist in tonnage, number of men, and number and

[18] Report, 87.

size of guns. In the first engagement, which practically decided the battle, six American and seven Spanish ships participated. The total tonnage of the American ships was 19,000 tons, and of the Spanish 11,500 tons. The total number of men on the American ships was 1611, and on the Spanish 1497. Dewey's guns, counting only the larger ones, were 53 in number, Montojo's 37.[17] Dewey's largest were ten 8-inch guns, and Montojo's seven 6.2-inch guns. The superiority of the Americans, however, was somewhat reduced by the Spanish shore batteries, mounting six or more guns. Only one of these appears to have played much part in the first engagement.[18] If we count the Spanish forces on shore, Montojo's men exceeded Dewey's.

On the morning of May 2 the fleet returned to Cavite where it now established its headquarters. A landing party was sent ashore to destroy the batteries at Sangley Point and Cañacao; and the cable to Hong Kong was cut, since the governor-general refused Dewey the use of it. On the 3d the Spanish forces evacuated the Cavite arsenal and the Americans took possession. On the same day the *Raleigh* and *Boston* received the surrender of the fortifications at the entrance of Manila Bay and destroyed their guns. As it was impracticable for Dewey to guard and subsist prisoners, he parolled them and permitted them to make their way to Manila. He also sent the wounded Spaniards to Manila, with their surgeons and nurses, under a flag of truce. A guard of marines was stationed at Cavite to protect the public property. On the afternoon of the 5th the *McCulloch* was sent to Hong Kong to cable home an account of the work of the fleet, which duty was performed by Lieutenant Brumby on the 7th, almost a week after the battle.[19]

The news of the glorious victory aroused much enthusiasm in the United States, and Dewey at once became the hero of the nation. President McKinley made him a rear-admiral and, in the name of the American people thanked him, his officers, and his men for their great achievement. On May 10, by joint resolution, Congress tendered its thanks to him and his squadron;

[17] Neeser, R. W. Statistical and Chronological History of the United States Navy, i, 250-251. The numbers of men engaged are from Mr. Neeser's book. See also Reports, 72, 109.

[18] Reports, 91.

[19] Massachusetts Military Historical Society Papers, xii, 383-387; Reports, 71-72; U. S. Revenue Cutter Service in the War with Spain, 15.

and on June 3 it voted to him a sword of honor, and to his officers and men bronze medals. On March 2, 1899, it revived the grade of admiral, previously filled by only Farragut and Porter, and on the same day Dewey was promoted to the new rank. All his chief officers were advanced from two to ten numbers in their respective grades for eminent and conspicuous conduct in battle.

Having destroyed the Spanish fleet and made himself master of Manila Bay, Dewey turned his attention to Manila, which was well defended by more than thirty guns, thirteen of them larger than the largest guns of the American fleet,[20] and by some ten thousand Spanish troops. He felt able to capture the city as soon as his ammunition was replenished; but, since he had not sufficient means to hold it, he decided to await the arrival of reinforcements from home. On May 13 he wrote as follows to the Secretary of the Navy: "I can take Manila at any moment. To retain possession and thus control Philippine Islands would require, in my best judgment, well-equipped force of 5000 men."[21]

Soon after the battle of Manila Bay the commodore and the governor-general agreed that neither should open fire upon the other, and henceforth the American ships were free to move about off Manila without risk of being fired on by the fortifications of the capital. To prevent the enemy from receiving supplies, Dewey established a strict blockade off Manila, the maintenance of which was his principal duty during the three months that he patiently waited for reinforcements. The squadron established itself at Cavite, where it fitted out a repair shop and naval depot. It was kept in touch with the government at Washington by means of the *McCulloch* and *Nanshan*, which were used as dispatch boats to ply between Cavite and Hong Kong. The prize transport *Manila* was commissioned and added to the fleet. On May 12 the gunboat *Callao* was taken while attempting to run the blockade, and she also was commissioned. On June 29 the *McCulloch* captured the Spanish gunboat *Leyte*, which was returning to Manila with a load of refugees.

For some weeks after the battle of Manila Bay, Dewey's position in the Philippines was by no means secure, and he was greatly embarrassed by several trying circumstances. About the middle of June a Spanish fleet of twelve vessels under Admiral

[20] Proceedings of the U. S. Naval Institute, xxvi, 279.
[21] Reports, 97-98.

Camara, considerably stronger than Dewey's fleet, sailed from Spain for the Philippines by way of the Suez Canal. On the arrival of Camara in the islands, the naval superiority would pass to the Spanish, unless in the meantime the Americans should be reinforced. Dewey planned, in case the Spanish fleet arrived before his reinforcements, to leave Manila Bay and sail eastward to meet them and then return and fight the enemy. The destruction of Cervera's fleet at Santiago caused the recall of that of Camara after it had passed through the Suez Canal, and thereby removed one of Dewey's annoyances.

Another source of trouble was the Filipino insurgents. The insurrection against Spanish rule in the islands that began in 1896 was greatly encouraged by Dewey's victory. On May 19, 1898. Emilio Aguinaldo, an exiled leader of the insurgents, returned to Cavite on board the *McCulloch* and at once put new life into the insurrection by organizing an army and government. He received encouragement from Dewey who furnished him with arms, but who refused to coöperate with him or to bind the American government to support him. It was not long before Aguinaldo and his followers began to embarrass the Americans. With accurate prevision of the future, Dewey wrote as follows on July 26: "Merritt's most difficult problem will be how to deal with insurgents under Aguinaldo, who has become aggressive and even threatening toward our army." [2]

Soon after the battle of Manila Bay Japan and the leading European nations sent one or more ships to the bay to protect their interests in the Philippines.

The receipt at Washington of the news of Dewey's victory of May 1 found the government unprepared to meet the emergency that had arisen in the Philippines. With much energy and dispatch, however, it immediately made arrangements to send out a land force and several naval vessels. Two months elapsed before the first reinforcements arrived at Cavite. In expectation of their arrival Dewey sent the *Baltimore* to Cape Engaño to convoy them to port. On June 30 the little fleet consisting of the cruiser *Charleston*, Captain Henry Glass, and three army transports, reached their destination. On her way out the *Charleston* stopped long enough at the Ladrone Islands to seize the coaling station of Guam. She was loaded with ammunition for the

[2] Reports, 118.

squadron. On July 17 the second expeditionary force, and on the 30th the third, arrived at Cavite. The commander of the American army, Major-general Wesley Merritt, reached Cavite on the 25th. On August 4 the squadron was further strengthened by the arrival of the ironclad monitor *Monterey* and the collier *Brutus*. The military forces in the Philippines were then regarded as quite sufficient to hold Manila. Dewey's long period of anxious waiting was about to come to an end.

Hemmed in by the fleet and by Merritt's army and the army of the insurgents, the Spaniards were in a critical position. Their food had been reduced chiefly to rice and horse flesh, the supply of which however was abundant. Aguinaldo had cut off part of their supply of water, and much sickness prevailed in the city. Their troops, regular and irregular, numbered about thirteen thousand. The American land forces numbered about ten thousand, and the insurgents about fifteen thousand. The arrival of the *Monterey* shifted the advantage in calibre of guns to Dewey, as she carried two 12-inch and two 10-inch guns, while the largest Spanish cannon were four 9.5-inch breech-loading rifles.

The Spanish were still anxious to prevent the bombardment of their city, and the Americans wished if possible to capture it without a useless destruction of life and property. With this in view informal negotiations were conducted by Dewey with the governor-general, by means of the Belgian consul, in the latter part of July.[23] On August 7 Dewey and Merritt sent a joint note to the governor-general notifying him that operations against Manila might begin within forty-eight hours, and asking him to remove his non-combatants. He replied that he had no places of refuge for them. On the 9th the American commanders demanded the peaceful surrender of the city and of the armed forces therein, urging the governor-general to prevent a useless sacrifice of life. "Every consideration of humanity," they said, "makes it imperative that you should not subject your city to the horrors of a bombardment."[24] The governor-general asked that time be given him to consult his home government, but his request was peremptorily refused. He now let it be known that the honor of Spain and the Spanish army would be satisfied with

[23] McClure's Magazine (New York), vii, 171-183.

[24] Annual Reports of the War Department for 1898, i, 47.

a simulated battle and that he would make only a nominal resistance.[25] The American commanders, however, took no chances, and prepared their forces for a stubborn fight should it be offered them.

A combined attack of the army and navy was planned for the 10th, and the navy was disappointed that it did not then occur. The army however needed more time for preparation, and the 13th was finally fixed upon. About nine o'clock in the morning of that day the army and navy began to move toward Manila, the navy steaming over from Cavite. The army advanced to the southern suburbs of the city, marching in two divisions, one commanded by General Greene and the other by General MacArthur. The several ships of the navy were assigned various duties. The *Zafiro* served as the flagship of General Merritt. The *Callao* and *Barcelo* (a captured tug) stood close in shore to support the troops under Greene. The *Monterey, Boston, Charleston, Baltimore* and *McCulloch* took positions covering the defenses of the city to the northward of Malate, situated on the coast in the southern suburbs. The *Olympia*, with Dewey on board, *Raleigh* and *Petrel* covered the defenses at Malate, distant therefrom about three thousand yards.

At about 10 a. m. the three last named vessels and Greene's troops opened fire upon Malate. The fort at that point fired but a single shell, and the forts to the northward did not fire at all. Neither did Dewey's ships to the northward fire. The troops, however, encountered some resistance. At about 10.30 a. m. the *Olympia, Raleigh* and *Petrel* ceased firing, and Greene's men took possession of the fort at Malate. Both divisions of the army now advanced on Manila, and about eleven o'clock a white flag was displayed at the southwest bastion of the city wall, a signal that the Spanish had surrendered.

Soon Lieutenant T. M. Brumby representing Dewey, and Lieutenant-Colonel C. A. Whittier representing Merritt went ashore, Brumby taking with him the *Olympia's* largest flag, which he intended should displace the Spanish colors. These two officers were soon followed by Merritt who proceeded to the palace of the governor-general to confer with him. At 3 p. m. Dewey's ships anchored off Manila, and an hour later the Second Oregon

[25] The Century Magazine, lvii, 936; Barrett, John, Admiral George Dewey, 144; Proceedings of the U. S. Naval Institute, xxv, 304.

Regiment was landed to serve as a provost guard. About five o'clock the American and Spanish generals signed preliminary terms of capitulation, and shortly thereafter the Spanish colors on the sea front were hauled down, and the flag of the victors was hoisted by Lieutenant Brumby, and was saluted with twenty-one guns from each ship of the squadron. Before the close of the day a considerable army of American soldiers were within the city, and a party of army generals had dined in the palace vacated by the governor-general and had smoked their cigars in the lofty rooms of viceroyalty, hung with splendid old portraits of Spain's rulers in the Philippines.[26]

The navy suffered no losses of any kind. The army had five men killed and forty-three wounded. The loss of the Spanish must have been much greater. The Americans captured some thirteen thousand prisoners, twenty-two thousand small arms, ten million rounds of ammunition, about seventy pieces of modern artillery, several hundred ancient bronze pieces, an elaborate fortification of the Vauban type with nearly three miles of parapet, an outer line of field defenses nearly seven miles in length, a city of about three hundred thousand inhabitants, and nine hundred thousand dollars of public money.[27]

On the day after the surrender a commission composed of American and Spanish officers, Captain B. P. Lamberton representing the navy, settled the final terms of capitulation, and General Merritt issued a proclamation establishing a military government over Manila. Dewey at once raised the blockade and opened the city to commerce. He appointed Captain Henry Glass captain of the port, who soon cleared away the obstructions in the Pasig River placed there by the Spanish, and reestablished the lights and aids to navigation. On August 16 Merritt received a cablegram containing the text of President McKinley's proclamation directing a cessation of hostilities, which he at once published.

On August 21 President McKinley cabled congratulations to Dewey, as follows: "Receive for yourself and the officers, sailors, and marines of your command my thanks and congratu-

[26] Reports, 119; Stickney, J. L. Life and Glorious Deeds of Admiral Dewey, 114; Annual Reports of the War Department for 1898, i, 43; Army and Navy Journal, xxxv, 1053; Scribner's Magazine, xxiv, 687.

[27] The Century Magazine, lvii, 931.

lations and those of the nation for the gallant conduct all have again so conspicuously displayed."[28] The Spanish-American War in the Philippines was at an end.

IV.

CHIEF EVENTS SINCE THE SPANISH-AMERICAN WAR, 1898-1910.

By the treaty of peace which brought to an end the Spanish-American War the United States acquired the Philippine Islands. This acquisition had a far-reaching effect on the navy in the East Indies and the Far East. The navy was now provided with a permanent base for operations in Asiatic waters, and was rendered in a measure independent of the naval facilities at Hong Kong, Shanghai, and Yokohama. The duties of the Asiatic squadron were greatly increased, and as a result its size was much augmented. To the old center of its activities, China-Japan, was added a new center, the Philippine Islands.

To meet the changed conditions on the Asiatic station, the squadron, in 1900, was divided into two divisions: the northern squadron, for service in the northern waters of the station; and the southern squadron, for service in the Philippines. In the following year each division was given a squadron commander. In 1907, in accordance with the Navy Department's policy of concentrating its fleets, the Asiatic and Pacific squadrons were consolidated into the United States Pacific Fleet, with headquarters at San Francisco. The new fleet consisted of three squadrons and two torpedo flotillas. Two squadrons and one flotilla were stationed in Asiatic waters.

The commanders-in-chief of the Asiatic squadron, their principal flagships, and their periods of service, from 1898 until 1907, were as follows:

Admiral George Dewey, *Olympia*, 1898-1899.
Captain A. S. Barker, *Oregon*, 1899.
Rear Admiral J. C. Watson, *Baltimore* and *Brooklyn*, 1899-1900.
Rear Admiral G. C. Remey, *Baltimore*, 1900-1902.
Rear Admiral Frederick Rodgers, *New York*, 1902.
Rear Admiral Robley D. Evans, *Kentucky*, 1902-1904.
Rear Admiral P. H. Cooper, *Wisconsin*, 1904.

[28] Quoted in J. L. Stickney's Life and Glorious Deeds of Admiral Dewey, p. 116.

Rear Admiral Yates Stirling, *Wisconsin*, 1904-1905.
Rear Admiral William Folger, *Baltimore*, 1905.
Rear Admiral C. J. Train, *Ohio*, 1905-1906.
Rear Admiral W. A. Brownson, *West Virginia*, 1906-1907.

After the Spanish-American War Cavite became the principal naval station of the squadron in the Philippines. Here were situated repair shops, storehouses, officers' quarters, barracks, and a temporary naval hospital. The station, however, was deficient in many particulars, most especially in docking facilities and requisites for repairing the larger vessels. In 1905, however, it was employing more than three thousand men. In that year a permanent naval hospital was constructed at Cañacao, about a mile from Cavite. In 1899 headquarters for the marines in the Philippines were established at Cavite, and during that and the two following years small detachments of marines were detailed as guards and garrisons at no less than nineteen places in the archipelago.[29] Coaling stations were maintained at Cavite, Isabela de Basilan, Cebú, and Polloc.

Before 1898 the Spanish had begun the construction of a naval station at Olongapo in Subic Bay, a situation regarded by them as superior to Cavite in Manila Bay. Soon after the ratification of the treaty of peace, the establishment of a naval base in the Philippines, adapted to the defense of the islands, came up for consideration. Admiral Dewey and several naval boards reported that Olongapo was the proper place for a great naval station. The army recommended Cavite. For several years this difference of opinion caused a deadlock, and Congress failed to make a selection. In 1905, however, that body appropriated upwards of a million dollars toward the improvement of Olongapo, and in the following year the Dewey drydock was established there. In the meantime the success of the Japanese in their war with Russia, and their naval supremacy in Asiatic waters, somewhat modified the strategic problems involved in the defense of the Philippines. In 1909 a joint army and navy board recommended the maintenance of a small docking and repair station at Olongapo and the establishment of the main base for the Pacific at Pearl Harbor, Hawaii. This recommendation has been approved by the Secretary of the Navy.

[29] Collum, R. S. History of the U. S. Marine Corps, 382.

The effect of the Spanish-American War and the events immediately succeeding it on the size of the Asiatic squadron may be seen from the following figures giving the number of vessels in the squadron on January 1, for the six years 1898-1903: 1898, 6; 1899, 30; 1900, 35; 1901, 52; 1902, 48; 1903, 28. The large increases made in 1899-1901 were caused by the Philippine insurrection and the relief expeditions to Peking. For the four years following the insurrection, which came to an end in 1902, the average number of vessels in the squadron was twenty-six. Many of the vessels added to the fleet during the insurrection were small gunboats adapted for blockade duties.

It is probably too early to write a full account of the Philippine insurrection and the relief of the foreign legations at Peking. Many of the requisite documents still lie buried in the official archives, and are more or less inaccessible to students. The Navy Department has been somewhat negligent in publishing the reports of its officers, and some of its officers have been negligent in reporting their operations. It is possible, however, to describe the work of the navy in China and the Philippines in a more or less general and cursory way. This much only will be here attempted.

The Philippine insurrection began on February 4, 1899, with an attack by the insurgents on the American line outside of Manila.[39] Thence it spread over Luzon, and thence to the islands to the southward thereof. The leading part in the war was of course played by the army, and the minor part by the navy. The work of the latter service consisted chiefly in maintaining a blockade of the ports and coasts of the archipelago, in shelling the fortifications of the enemy, in taking possession of captured towns, in sending ashore landing parties to aid the army, in conducting exploring expeditions around the coasts and through the islands, in convoying army transports, and in disembarking troops.

In 1899 the navy's most important operations were conducted near Manila, on the west and north coast of Luzon, and in the islands of Panay, Cebú and Mindanao. In the engagements near Manila in February and March, 1899, Dewey's vessels in the bay frequently shelled the insurgents on shore, and coöperated

[39] For the Philippine insurrection, see R. W. Neeser's Statistical and Chronological History of the United States Navy, vol. ii, pp. 268-281, 468-471; and the references there given.

with the army with excellent results. A small detachment of marines, under Ensign Cleland Davis, advanced with the troops under General MacArthur and fought with great gallantry. On March 4 a party that was sent ashore at Malabon to take some photographs showing the effect of gun-fire, had a lively skirmish with the enemy. About the middle of June nine ships coöperated with the army in a movement near Cavite, during which a party of ninety men from the *Helena* and *Monadnock* landed and rendered valuable assistance. On October 3 a detachment of sailors and marines participated in the general advance of the army toward Imus. Five days later a force of three hundred fifty-six marines, under the command of Lieutenant-Colonel George F. Elliott, attacked the insurgents near Novaleta, and captured the town. The insurgents had eleven men wounded. This was the last important operation of the navy near Manila in 1899.

To the northward the principal naval operations were in Subic Bay and Lingayen Gulf and at Vigan. On September 14 the *Charleston,* Captain G. W. Pigman, bombarded a fort in Subic Bay and landed a detachment, which took possession of it and destroyed its guns. Later in the same month the *Monterey, Charleston, Concord,* and *Zafiro* were operating in the same waters, and under the cover of their guns, a detachment, commanded by Lieutenant J. D. McDonald, went ashore and destroyed one of the enemy's cannon. In December the *Oregon* and *Baltimore* took possession of the navy-yard at Olongapo, and a marine force was stationed in the town as a garrison.

The campaign in Lingayen Gulf began in March, when the *Baltimore* shelled some of the enemy's works. In September the *Paragua* engaged the enemy from the gulf and silenced his fire, and in November five gunboats and a transport covered the landing of General Wheaton's army at San Fabian.

The capture of Vigan, on the northwest coast of Luzon, was one of the important operations of the year. On November 26, after the *Oregon, Callao,* and *Samar* had driven the insurgents from their trenches about three miles from Vigan, a detachment consisting of one hundred ninety-two sailors and marines, under the command of Lieutenant-Commander Alexander McCracken, was landed. Its movements on reaching the beach are thus described by its commander.

"The column was formed, with the marines as an advance guard, they having been landed first and deployed, and started towards Vigan. There was no opposition, and nearly all the houses displayed white flags. As we neared Cavayan, where an American flag had been hoisted on the church tower, a delegation, carrying the American flag and white flags, came towards us, beating drums to attract our attention; it proved to be the chief officials of the town, who expressed their gratification at our arrival, and a desire to have us take possession of the country. Intrenchments were discovered as we approached Vigan, but they were deserted.

"When we arrived on the outskirts of Vigan we were met by a kilas that contained Mr. A. Sonnichsen and civil officials from Vigan. They came out to tell us that the President of the Province with all the officials were at the Bishop's palace to welcome us to Vigan. Soon after, a brass band of native musicians met us, and was placed at the head of the column. The streets were lined with people who carried white flags and cheered loudly for the Americans.

"Upon our arrival at the Plaza we found the Presidente Provincial, Mr. Mariano Acosta, and the other officials, drawn up in line in front of the Bishop's palace to welcome us. The Presidente presented a letter of welcome in English, which, with a list of the officials, was forwarded to you immediately. The American flag was hoisted over the Bishop's palace, the battalion presenting arms, at 12 o'clock noon by the tower clock in the Plaza. We were also met by many Spanish prisoners, who met us with every sign of joy. The battalion was quartered in the barracks lately deserted by the insurgent troops, but was later on in the afternoon transferred to more suitable quarters in the Bishop's palace. . . . The Presidente was directed to administer his office as before our arrival, except that grave cases were to be referred to the Commanding Officer."[21]

On the following day McCracken made a reconnaissance to the eastward of Vigan, and discovered an insurgent outpost with which he exchanged several shots. He also cut the telegraph wires leading into the interior, and he sent the captured Spanish prisoners to the *Oregon*. On the arrival of a company of U. S. infantry, on the 28th, he turned the town over to the commander of the troops, and withdrew his forces.

[21] U. S. Navy Department, Bureau of Navigation, Files 202555.

In the latter part of the year several vessels patrolled the north and northwest coast of Luzon. On September 14 the *Monterey* and *Concord* captured two schooners at Aparri. In December the *Wheeling* and *Panay* were coöperating with the army on the northwest coast.

To the southward of Luzon the most important naval operations in 1899 were at Panay, whose capital Iloilo was the second port in the archipelago. In the capture of this port the naval vessels *Boston*, Captain G. F. F. Wilde, and *Petrel*, Commander C. C. Cornwell, coöperated with a division of the army under General Miller. On February 10, Miller addressed an ultimatum to the insurgents at Iloilo demanding their withdrawal before sunset of the following day and forbidding them to erect additional defenses under penalty of bombardment. On the morning of the 11th they began to improve their defenses; and the *Boston* and *Petrel* opened fire on them, and forced them to abandon their guns and retreat. A landing party, drawn from both vessels and commanded by Lieutenant A. P. Niblack, of the navy, now went ashore, took possession of the enemy's intrenchments, and occupied the town. In these operations the Americans lost one man wounded; the loss of the Filipinos was probably slight. The enemy attempted to fire the town before abandoning it, but by the prompt action of Niblack this was prevented. The American, British and German consulates and the Filipino and Chinese quarters, however, were burned. After holding the city for an hour, Niblack turned it over to General Miller.[22]

On February 20 Commander Cornwell, having received orders from Wildes to take possession of Cebú, the capital of the island of the same name, sailed from Iloilo, with the *Petrel*, for that town. Reaching his destination on the following day, he sent word to the local authorities that he would be glad to consult with them respecting the occupation of Cebú. A few hours later a committee came on board the *Petrel*, and Cornwell read to it the proclamation of President McKinley setting forth the beneficent objects of the American government in behalf of the Philippines, and urged it to consider the uselessness of offering resistance and the saving of life and property that would be effected by a peaceful surrender. On the 22d the authorities sent a representative to the *Petrel* to say that they would make no resistance, but that they

[22] U. S. Navy Department, Bureau of Navigation, Files 166819.

wished to register a protest against the action of the Americans. A landing party, under the command of Lieutenant J. H. Bull, now went ashore and hoisted the American flag, which was saluted by the *Petrel* with twenty-one guns. On the return of the party, Cornwell, accompanied by Bull and two orderlies, landed and met Señor Flores, the governor and commander-in-chief of the island, at the governor's house. He now assumed charge of the government; and he informed the governor that he would be glad to have his assistance, that he would retain in office such officials as desired to remain, and that he would guarantee as far as possible individual liberty to the citizens and the protection of their property. He appointed a collector of customs and a captain of the port, and caused the American flag to be hoisted on the government house, where he established his headquarters. He retained possession of the town until relieved of his duties by an officer of the army.[22]

In addition to the occupation of Iloilo and Cebú, several other naval operations took place in 1899 in this part of the archipelago. In October the *Concord* bombarded the town of Tigbanan, in Iloilo Straits, and prevented the enemy from crossing between Panay and Negros. Assisted by several other vessels, she also bombarded the town of Bonati and compelled the enemy to abandon it. In November the *Concord* shelled a town on Carabao Island. In December the *Concord*, *Paragua* and *El Cano* captured the town of Romblon, situated on an island of the same name north of Panay.

Several vessels in 1899 operated to the southward of Panay and Cebú. In March the *Boston* reconnoitered Zamboanga and the Sulu Islands, and a few weeks later the *Concord* and *Petrel* convoyed some Spanish gunboats from Zamboanga to Manila. From June to December the *Castine* cruised in the Sulu Islands with a view to the prevention of uprisings among the natives and to coöperation with the army. On November 16 the *Castine* and *Manila*, aided by some friendly natives and Moros, captured the town of Zamboanga, and two days later Commander S. W. Very, of the *Castine*, received the surrender of the province of Zamboanga.

The record of prizes taken by our vessels in the insurrection is very incomplete. Among the captures in 1899 were the two

[22] U. S. Navy Department, Bureau of Navigation, Files 166819.

Filipino steamers *Taaleno* and *Mundaca*. The Americans that year lost the gunboat *Urdaneta*, Naval Cadet W. C. Wood, which was destroyed by the insurgents at Orani, Luzon. The *Charleston* was wrecked on a coral reef off Kamiguin Island, all her officers and men being saved. In April the insurgents captured at Baler, Luzon, Lieutenant J. C. Gilmore and fourteen men.

The operations of the navy in the Philippines during 1900 were of the same general character as those of the previous year. The duties of the smaller vessels in preventing illicit trade, however, seem to have been even more exacting than formerly. The principal fields of naval activity had now shifted to the neighborhood of Olongapo, to Southern Luzon, and to the islands of Samar and Leyte. Only the more important operations of the navy for this year will be here mentioned.

In January Commander H. Knox, in the *Princeton*, took possession of the Bantan group of islands, and in April Commander E. H. Gheen, in the *Marietta* captured Baler, Luzon. In February, March, and April parties of marines made several expeditions and captured or destroyed several towns near Olongapo. In a skirmish with the enemy on February 16, the marines had two men killed. In the same month a party under Lieutenant J. H. Gibbons rescued and recaptured in Southern Luzon ten Americans, four hundred and sixty Spanish officers and soldiers, and several priests, merchants and Filipinos. In May the *Pampanga* landed a force of men and captured a town in the island of Leyte. In the summer the most important movements of the navy were in Samar, Panay, and Mindanao, where the enemy's entrenchments were frequently shelled. During 1900 more than sixty-five small vessels, chiefly bancas and proas, were taken by the American ships.

From January, 1901, until April 1, 1902, when the insurrection in the Philippines came to an end, more than twenty-five engagements or hostile movements took place in which the navy participated. The principal fields of its activity were southern Luzon and Samar. In January, 1901, one of the boats of the *Don Juan de Austria* captured twelve prisoners near Donsol, southern Luzon. In March the *Vicksburg* coöperated with the army in the capture of General Aguinaldo. From November, 1901, to March, 1902, parties of marines had frequent engagements in Samar, which resulted in considerable loss to the enemy.

Among the vessels that made detailed reports of naval operations, is the *Don Juan de Austria,* Commander T. C. McLean. In January, 1901, she was cruising off southern Luzon and the adjacent islands. A brief extract from the report of her commander will serve to give some notion of the work performed by the vessels on the blockade during the insurrection:

Jan. 21. Proceeded from Boco Engaño, Burias Island to Donsol, Luzon, with 47 bags of rice seized by the *Arayat.* Turned the rice over to army for storage at Donsol.

Jan. 22. Left Donsol in early morning: patrolled the east coast of Burias, stopped at Claveria and anchored at San Pascual, Port Busin.

Jan. 23-24. Examining town, and vicinity of San Pascual and adjacent waters and obtaining various information. A list of boats and owners belonging to San Pascual is enclosed herewith.

Jan. 25. Left Port Busin. Patrolled coast of Burias, overhauling native boats. Off Claveria overhauled the *Parao Gonsalito,* returning to San Pascual with license just obtained at Donsol. Interrogation of master of *Parao* resulted in his confirming, unintentionally, my suspicions in regard to the real conditions at Claveria and San Pascual. Ostensibly, because of his having two bags of rice on board and because of his improbable statements in regard to having paid money in addition to fines, at Donsol, the master of the *Parao* was held on board this ship for further examination, which proved to be of great service. The *Parao* and crew were allowed to proceed to San Pascual.

In the evening brought the ship to anchor off Donsol. In the night sent the steam launch in charge of Cadet Allen Buchanan, U. S. N., with armed boat's crew in an expedition to Pillar with an army officer, seven soldiers, and three native guides. The object of this expedition was the capture of an insurgent captain. The expedition was very well managed by the army officer, Lieut. Cole, U. S. V., and failed only because the insurgent captain had gone to Cariguran that day. . .

Jan. 28. About three o'clock in the morning sent the troops, the scouts, and an armed party of sailors ashore in the steam launch, two cutters and a whale boat. Steam launch and 1st cutter mounting Colt automatic guns, boats' crews armed with rifles. Ensign John Halligan, U. S. N., in charge of boats and landing party of sailors. Asst. Surgeon J. A. Murphy, U. S. N., was the medical officer of the landing party, troops and sailors. The object of this expedition was to capture General Ramon F. Santos who was in charge of the district, and receiving supplies of rice, money, etc., brought off by boats to Maringondon. Santos escaped, but his adjutant was captured. The adjutant had a paper signed by Santos, giving him a short leave of absence. In the skirmish actions an insurgent officer, mounted, was killed, also several others, and some were wounded. No casualties on our side.[84]

The anti-foreign movement in China that culminated in the boxer uprising of 1900 caused serious disturbances as early as

[84] U. S. Navy Department, Bureau of Navigation, Files 262508.

1898.[88] In the fall of that year several foreign governments responded to the call of their ministers at Peking for protection. The government at Washington sent Lieutenant Dutton and eighteen marines to Peking to act as a guard to the American legation there. After the excitement quieted down, the marines were withdrawn.

Early in 1900 the demonstrations against foreigners were renewed, and the Navy Department found it expedient to augment its force in Chinese waters. In May the foreign ministers again appealed for protection and several occidental governments at once responded. A company of American marines, fifty-six in number, under the command of Captain B. H. McCalla, of the navy, was dispatched from Taku to Peking. This company was the first of the foreign detachments to enter the city. Its commander, McCalla, shortly returned to Tientsin, leaving the men under the command of Captain J. T. Myers.

Early in June the situation at Peking became still more critical, communication with Tientsin was cut off, and the legations were threatened with attack. The various foreign governments maintaining diplomatic representatives in China prepared to send forward a relief expedition. Soon McCalla had a detachment of marines numbering one hundred twelve men ready to join the allied forces. On June 10 an international army composed of British, Americans, Japanese, Italians, and Austrians left Tientsin for the capital, and it was shortly joined by detachments of Germans, French, and Russians. The entire force numbered two thousand and sixty-six officers and men, and was commanded by a British vice-admiral, Sir Edward Seymour. The expedition met with considerable opposition, and at the end of ten days it was still forty miles from the capital, having reached Lang-fang. Here, finding the railway useless, possessing insufficient means for an extensive campaign, encumbered by more than two hundred wounded men, and entirely cut off from communication both in the front and rear, it decided to fall back to Tientsin. It retreated as far as the imperial arsenal, situated a few miles from that city, which it captured, and there halted and awaited reinforce-

[88] For the operations of the navy in the Boxer uprising, see R. W. Neeser's Statistical and Chronological History of the United States Navy, vol. ii, 276-279, and the references there given; Mrs S. P. Conger's Letters from China, 24-29, 90-159; and R. S. Collum's History of the U. S. Marine Corps, 410-427.

ments. In this expedition, the Americans displayed great gallantry, losing four men killed and twenty-eight wounded, among the latter being McCalla, who was wounded three times.

During the advance and retreat of Seymour's expedition, the situation at Tientsin had become critical. The foreign settlement was threatened, and the communication between the city and Taku was interrupted. It was necessary for the allies to obtain possession of Tientsin and its environs before again attempting the relief of Peking. On June 22 one hundred thirty American marines, under Major L. W. T. Waller and a Russian force more than three times as large made an unsuccessful effort to relieve the foreigners at Tientsin, and were surrounded and almost overpowered. The marines lost four men killed and seven wounded. Two days later the allies, two thousand strong fought their way to the foreign settlement outside the walled city, and on the following day relieved Seymour and McCalla at the imperial arsenal.

The allies next turned their attention to the walled city, which was occupied by Chinese troops. On July 9 they assaulted the right flank of the enemy, losing forty-five men and inflicting a loss of about five hundred. Four days later they made a general attack, blew in the south gate of the city, and entered and took possession of Tientsin. In the first attack the Americans were represented by Waller and his marines, and in the second by three hundred forty-eight marines under the command of Colonel R. L. Meade and two battalions of infantry under the command of Colonel E. H. Liscum. The latter officer and Captain A. R. Davis of the marine corps were killed. On the death of Liscum, Meade succeeded to the command of the Americans. Both officers and men fought with great bravery in these actions. The loss of the marines was twelve killed and fifty-seven wounded.

Communication with the legations had now been cut off for several weeks, and the belief had become general that the ministers and other foreigners in Peking had been killed. Under these circumstances, the allies planned to collect an army of eighty thousand troops before marching upon Peking. The American government contemplated sending some eighteen thousand men to China, and it selected General Adna R. Chaffee to command them. While the allied forces were being concentrated at Taku and Tientsin, information was received from the American min-

1898." ... foreign population at Peking respon... ...ction would prevent a general The ... ...is news a relief expedition, con- eight... ...erican, British, Japanese, Russian, legati... ...ganized. It left Tientsin on August 4, were ... ...Pekin and relieved the imprisoned I... ...mmes in this expedition numbered ren... ...were commanded by Major W. P. its ... ...about ten men.

ap... ...ere none too soon. From June 19 to o... ...almost daily, and from the latter date n... ...several severe attacks. The detach- ... ...under Myers occupied a strategic posi- ... ...on the city wall, where it established a ... ...repeatedly attacked by greatly superior ... ...occasions temporarily driven from the wall, ...dislodged, and was still holding this vital ... ...place. On July 3 it made a brilliant sortie ... ...captured several guns and standards. Its ... ...was seven killed and fourteen wounded, ...its commander, Myers, was wounded.

...pression of the insurrection in the Philippines and ...ing in China, the navy settled down to the per- ...e duties. In the Philippines, however, sporadic ...e insurgents at times engaged its attention. In ...patrolling the coast of Mindanao and the Sulu ...aiding the army in suppressing illicit trading. ... a naval detachment in coöperation with the ...several of the enemy's cottas by assault at Mount ...ud. In the fall of 1908 the battleship squadron in ...nd the world visited the Philippines and the Far ...was received with most lavish hospitality.

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A SHORT METHOD OF CALCULATING THE ZENITH DISTANCE.

By H. B. GOODWIN.

It is a leading characteristic of the St. Hilaire method of laying off position lines by means of "calculated altitudes," which is now coming into very general use, that it readily lends itself to the employment of tabular methods, whereby logarithmic calculation is either altogether dispensed with or very greatly simplified, as the case may be.

Such a method, devised by Lieut. Radler de Aquino, of the Brazilian Navy, was described at length in the PROCEEDINGS not long since. In the year 1910 Admiral Garcia Mansilla, of the Argentine Navy, published a volume of tables with the same object in view, and more recently Captain Guyou, of the French Navy, has brought out a compendious work of the same nature.

In each case the method followed presents novel and ingenious features of its own, but probably the most simple and easily intelligible work of the kind is that produced by Mr. F. Ball, a naval instructor in the British Navy. In this comprehensive work Mr. Ball gives the altitude corresponding to each complete degree of latitude and of hour angle between the values of 0° and 60° both of latitude and declination, the argument declination proceeding also by single degrees. And since in working by the St. Hilaire process the computer can take as his point of departure any position not far removed in latitude and longitude from the dead reckoning values, it is easy by a simple process of adjustment to obtain a point such that latitude and hour angle may each be represented by a complete degree. No interpolation is, therefore, required, except for the odd minutes of declination, which again is simplified by the use of a table specially designed for the purpose.

It happens, however, that a set of tables planned upon such an elaborate design as this is necessarily somewhat bulky, and that

the consequent expense of production places it beyond the reach of mariners in general, and it has occurred to the writer that there might perhaps be room for a volume of tables, which, proceeding generally upon the lines followed by Mr. Ball, would be of smaller dimensions, and consequently be more generally accessible to seamen.

The general idea upon which the proposed table would be based is this: In the triangle of position PXZ, P is the pole, Z the zenith and X the place of the body observed. Let us suppose that c, the colatitude, and h, the hour angle, are regarded as constant, and that z is the zenith distance corresponding to a given value of p, the polar distance. Let p be increased by a certain amount (Δp), and let z_1 be the zenith distance corresponding to the new value of the polar distance for the constant values c and h.

Then by Taylor's theorem,

$$z_1 - z = \frac{dz}{dp}(\Delta p) + \tfrac{1}{2}\frac{d^2z}{dp^2}\sin 1'(\Delta p)^2 + \tfrac{1}{6}\frac{d^3z}{dp^3}(\sin^2 1')(\Delta p)^3 + \ldots .$$

Let us suppose that z has been calculated and tabulated for given values of p, c, h, and, for the present leaving out of consideration the third term of the expansion, let $\frac{dz}{dp}(\Delta p)$ be denoted by Correction A, and let $\frac{1}{2}\frac{d^2z}{dp^2}\sin 1'(\Delta p)^2$ be indicated by Correction B.

Then

$$z_1 = z + A + B.$$

We will assume, then, that $\frac{dz}{dp}$, $\frac{1}{2}\frac{d^2z}{dp^2}\sin 1'$ have been calculated. It will be convenient to give the results in the form of logarithms.

Thus

$$\log A = \log\frac{dz}{dp} + \log(\Delta p),$$

$$\log B = \log\tfrac{1}{2}\frac{d^2z}{dp^2}\sin 1' + 2\log(\Delta p),$$

the logarithms of $\frac{dz}{dp}$ and of $\frac{1}{2}\frac{d^2z}{dp^2}\sin 1'$ being taken from the proposed table, and that of (Δp) from the ordinary table of logarithms of numbers.

Taking into account only these two terms of the series it will be sufficient to tabulate for each 8° of declination, so that by

including only 0°, 8°, 16°, 24° North and South, we should cover the whole range of declination from 28° N. to 28° S., thus effecting a very great saving in the size of the volume of tables necessary at the expense of a very little additional trouble in calculation.

It will first be necessary to obtain expressions for $\frac{dz}{dp}$ and $\frac{d^2z}{dp^2}$.

To FIND AN EXPRESSION FOR $\frac{dz}{dp}$.

From the triangle PXZ we have

$$\cos h \sin c \sin p = \cos z - \cos p \cos c.$$

Differentiating,

$$\cos h \sin c \cos p = -\sin z \frac{dz}{dp} + \sin p \cos c,$$

$$\therefore \sin z \frac{dz}{dp} = \cos c \sin p - \sin c \cos p \cos h,$$

$$= \cos c \sin p - \sin c \cos p \frac{\cos z - \cos p \cos c}{\sin p \sin c},$$

$$= \frac{\cos c \sin^2 p + \cos c \cos^2 p - \cos p \cos z}{\sin p},$$

$$\therefore \frac{dz}{dp} = \frac{\cos c - \cos p \cos z}{\sin p \sin z} = \cos PXZ.$$

To FIND AN EXPRESSION FOR $\frac{d^2z}{dp^2}$.

Since $\frac{dz}{dp} = \cos X$,

$$\frac{d^2z}{dp^2} = -\sin X \frac{dX}{dp}.$$

We have, therefore, to find an expression for $\frac{dX}{dp}$.

In the triangle PXZ the formula connecting X, p, h, c is

$$\cot c \sin p = \cot X \sin h + \cos h \cos p.$$

Differentiating,

$$\cot c \cos p = -\operatorname{cosec}^2 X \frac{dX}{dp} \sin h - \cos h \sin p,$$

$$\therefore \frac{dX}{dp} = -\sin^2 X \operatorname{cosec} h (\cot c \cos p + \cos h \sin p),$$

$$= -\sin^2 X \left(\frac{\cot c \cos p}{\sin h} + \cot h \sin p \right).$$

Substituting this value in the formula above,

$$\frac{d^2z}{dp^2} = \sin^3 X \frac{\cot c \cos p}{\sin h} + \cot h \sin p)$$

and

$$\log \text{ for Cor } B = \log \frac{d^2z}{dp^2} + \log(\tfrac{1}{2} \sin 1').$$

With regard to the algebraic signs of A and B, Correction A is *additive* for actual polar distance *greater* than tabular, *subtractive* for polar distance *less*, so long as the angle X lies in the first quadrant.

The rule is reversed when X is greater than 90°, and the cosine, therefore, becomes negative. This can only occur in the exceptional case when latitude of place is of same name as the declination, and smaller in amount. Correction B will be always *additive*.

THE METHOD OF TABULATION.

The arguments of the table will be three in number, viz., declination; proceeding by differences of 8° from 0° to 24°; the latitude, by single degrees from 0° to 60°; the hour angle, by differences of single degrees, *i. e.*, of 4 minutes of time.

The quantities tabulated would also be three in number, viz., the zenith distance, corresponding to the tabulated values of declination, latitude and hour angle.

The logarithm for Correction A, which, as has been shown, is simply $L \cos X$.

The logarithm for Correction B, obtained from the expression given above.

THE ADJUSTMENT OF THE DEAD RECKONING POSITION.

It is a feature common to tables of this nature that the point worked from upon the chart, that is, the point of origin for the intercepts, should be such that its latitude is an even degree. The longitude of the point also must be such as to give for the hour angle an even degree, or 4 minutes of time.

In the case of the latitude, no difficulty occurs, and it is only necessary to select the degree nearest to the D. R. latitude. To find the longitude the following artifice is adopted:

Find the hour angle of the body at Greenwich, *i. e.*, in the case of the sun the Greenwich apparent time, and express this hour angle in arc.

To this apply such an amount of arc, adding if the longitude is east, subtracting if it is west, as will make the hour angle resulting an exact degree, the amount of arc so applied being as near as possible to the D. R. longitude.

The arc thus applied will be the longitude of the position from which to work.

The following example will serve to illustrate the procedure:

In D. R. position lat. 28° 47′ N. longitude 27° 3′ W., when Greenwich apparent time was $3^h\ 47^m\ 32^s$, an altitude of the sun was observed. Find the latitude and longitude from which to work. The latitude is 29° N. For the longitude,

Greenwich apparent time (in arc)	56° 53′
Subtract	26° 53′
Hour angle	30° 00′

Thus 26° 53′ W., differing from the D. R. longitude by 10′, gives the exact value of 2^h for the hour angle.

DESCRIPTION OF TABLES I AND II.

To illustrate practically the method proposed, two specimen tables are appended. For each table the hour angle 2^h is adopted. Table I gives the values of the zenith distances and of the angle PXZ for declinations 0°, 8° and 12° of same name as latitude, and for each degree of latitude from 0° to 30°. It has not been thought necessary to proceed to higher latitudes than 30° because the higher the latitude the more exact are the results furnished by the method. The latitudes 0° to 30°, therefore, supply a sufficient test.

In Table II are given the logarithms for the calculation of corrections A, B and C for the three values of the declination, except that in the case of declination 8° the logarithm for C is omitted, since this value of the declination would only be included in the tables under the system where Correction C is left out of account, the computation being effected by the use of Corrections A and B only.

It should also be mentioned that although, for greater clearness of exposition, the value of the angle X is shown in Table I, this actual value is not really necessary, the value of $L \cos X$, given in Table II as the "Log for Cor A" being all that is required. By adding the column of zenith distances to Table II,

therefore, we should be able to dispense with Table I and give all the necessary details in a single table.

PRACTICAL RULES FOR THE USE OF TABLES I AND II.

To obtain a required zenith distance by means of the tables we should proceed as follows:

FOR CORRECTION A.

Find the difference, expressed in minutes, between the polar distance of body, measured from the elevated pole, and the nearest tabular value.

TABLE I.

ZENITH DISTANCES AND VALUES OF THE ANGLE *X*.

Hour Angle 2h.

Latitude.	Declination 0°.		Declination 8° (same name).		Declination 12° (same name).	
	Zen. Dist.	Angle *X*.	Zen. Dist.	Angle *X*.	Zen. Dist.	Angle *X*.
0°	30° 0′	90° 0′	30° 57′	103° 33′	32° 6′	109° 49′
1	30 1	88 0	30 41.5	101 40	31 43.5	108 3
2	30 4	86 0	30 28	99 45	31 22	106 16
3	30 8	84 1	30 16	97 49	31 2	104 27
4	30 14.5	82 2	30 5.5	95 51	30 44	102 35
5	30 22.5	80 4	29 57	93 53	30 27.5	100 41
6	30 32.5	78 7	29 50	91 53	30 12.5	98 46
7	30 44	76 12	29 45	89 53	29 59.5	96 49
8	30 57	74 18	29 42	87 52	29 48	94 51
9	31 12	72 25	29 41	85 51	29 38	92 53
10	31 28.5	70 34	29 41	83 49	29 30	90 51
11	31 46.5	68 45	29 44	81 48	29 24	88 50
12	32 6	66 58	29 48	79 48	29 20	86 49
13	32 27	65 13	29 54	77 48	29 17.5	84 46
14	32 50	63 30	30 1.5	75 49	29 17	82 43
15	33 13.5	61 49	30 11	73 50	29 18	80 41
16	33 39	60 10	30 22.5	71 54	29 21.5	78 39
17	34 5	58 33	30 35.5	69 59	29 26.5	76 37
18	34 33	56 59	30 50	68 5	29 33.5	74 36
19	35 2	55 27	31 6.5	66 13	29 42	72 36
20	35 32	53 57	31 24.5	64 22	29 52.5	70 37
21	36 3	52 29	31 44	62 33	30 4.5	68 39
22	36 35	51 4	32 5	60 46	30 18.5	66 43
23	37 8	49 40	32 24.5	59 3	30 34.5	64 49
24	37 42	48 19	32 51	57 21	30 51.5	62 57
25	38 17.5	47 0	33 16.5	55 41	31 10.5	61 7
26	38 53.5	45 43	33 43	54 4	31 30.5	59 18
27	39 30	44 28	34 11	52 28	31 53	57 32
28	40 75	43 14	34 39.5	50 56	32 16	55 48
29	40 45.5	42 3	35 10	49 25	32 41	54 6
30	41 24.5	40 54	35 41	47 56	33 7	52 27

TABLE II.

LOGARITHMS FOR CALCULATION OF CORRECTIONS.

Hour Angle 2h.

Declination 0°.			Declination 8° (same name).		Declination 12° (same name).		
Log Cor *A.*	Log for Cor *B.*	Log for Cor *C.*	Log for Cor *A.*	Log for Cor *B.*	Log for Cor *A.*	Log for Cor *B.*	Log for Cor *C.*
.....	6.4013	.....	9.36976	6.3000	9.53021	6.3121	2.562
5428	6.3974	.....	9.30582	6.3200	9.49115	6.3220	.....
8436	6.3935	1.989	9.22878	6.3400	9.44733	6.3320	2.492
01803	6.3895	.....	9.13355	6.3600	9.39713	6.3420	.....
14175	6.3835	2.275	9.00828	6.3800	9.33818	6.3521	2.422
23679	6.3779	.....	8.8307	6.3895	9.26806	6.3619	.....
31370	6.3703	2.266	8.5167	6.3990	9.18302	6.3718	2.316
37755	6.3589	.....	7.3088	6.3990	9.07442	6.3807	.....
43233	6.3475	2.519	8.5708	6.3990	8.9271	6.3897	2.079
48014	6.3362	.....	8.8595	6.3990	8.7016	6.3989	.....
52207	6.3249	2.575	9.03226	6.3990	8.1713	6.4081	1.333
55923	6.3073	.....	9.15421	6.3918	8.3088	6.4070	.....
59247	6.2897	2.605	9.24818	6.3846	8.7445	6.4060	1.912
62241	6.2720	.....	9.32495	6.3774	8.96005	6.4043	.....
64953	6.2544	2.617	9.38921	6.3702	9.10304	6.4027	2.271
67421	6.2344	.....	9.44472	6.3590	9.20922	6.3971	.....
69677	6.2143	2.613	9.49231	6.3478	9.29403	6.3916	2.446
71747	6.1918	.....	9.53440	6.3325	9.36449	6.3815	.....
73630	6.1693	2.598	9.57201	6.3173	9.42416	6.3715	2.555
75368	6.1468	.....	9.60561	6.3021	9.47573	6.3615	.....
76974	6.1243	2.572	9.63610	6.2869	9.52099	6.3515	2.621
78461	6.0982	.....	9.66368	6.2654	9.56118	6.3344	.....
79825	6.0721	2.539	9.68875	6.2439	9.59690	6.3173	2.645
81106	6.0460	.....	9.71121	6.2225	9.62892	6.3002	.....
82283	6.0198	2.497	9.73200	6.2011	9.65779	6.2832	2.669
83378	5.9924	.....	9.75110	6.1771	9.68397	6.2577	.....
84398	5.9651	2.451	9.76852	6.1532	9.70803	6.2322	2.678
85349	5.9359	.....	9.78478	6.1269	9.72982	6.2133	.....
86247	5.9067	2.401	9.79950	6.1006	9.74980	6.1945	2.668
87073	5.8781	.....	9.81328	6.0742	9.76817	6.1706	.....
87844	5.8495	2.347	9.82593	6.0478	9.78494	6.1467	2.635
Add P. D. ter than abular. *ubtract* P. D. *Less.*	Always *Additive.*	*Subtract* from *A.*	*Subtract* for P. D. *greater* than Tabular. *Add* for P. D. *Less.* — *Add* for P. D. *greater* than Tabular. *Subtract* for P. D. *Less.*	Always *Additive.*	*Subtract* for P. D. *greater* than Tabular. *Add* for P. D. *Less.* — *Add* for P. D. *greater* than Tabular. *Subtract* for P. D. *Less.*	Always *Additive.*	*Subtract* from *A.*

To the log of this difference add the "Log for Cor *A*" taken from the table.

The sum, rejecting 10, is the logarithm of Correction *A*.

FOR CORRECTION B.

To twice the logarithm of the difference between actual and tabular polar distance add the "Log for Cor *B*" from Table II.

The sum, rejecting 10, is the logarithm of Correction *B*. Apply Corrections *A*, *B* to the zenith distance tabulated in Table I, in accordance with the precepts at the foot of the respective tables.

EXAMPLES IN USE OF TABLES.

Example 1.—Find the sun's zenith distance for hour angle 2^h, in latitude 3° N., when the declination is 4° 6′ N. Here 8° is the nearest tabular value for the declination, the difference of polar distance (Δp) being 3° 54′, or 234′. Actual polar distance greater than tabular.

A		*B*	
Log for *A* (from Table II)	9.13355	Log for *B* (from Table II)	6.3600
Log 234	2.36922	2 Log 234	4.7384
(Sum)	1.50277	(Sum)	1.0984
Cor *A*	31.8′−	Cor *B*	12.5′+
Cor *B*	12.5′+	Zenith distance (from Table I)	30° 16′
	19.3′−	Corrections	19.3′−
		Zenith distance required	29° 56.7′

Here Correction *A* is subtractive for actual P. D. greater, because the "Log for *A*" is above the "bar," which, in Table II, for declination 8°, is drawn between the logarithms for 6° and 7° of latitude. This bar indicates the point at which the angle *X* passes from one quadrant to another, so that the cosine of the angle changes its sign, and the algebraic sign of the correction is altered accordingly. Reference to Table I shows that for latitude 6° the value of *X* is 91° 53′, and for latitude 7° it is 89° 53′.

Example 2.—Find the zenith distance of Procyon (Dec. 5° 27′ N.) for H. A. 2^h in latitude 25° N.

The nearest tabular value is again 8°, and the difference of polar distance 2° 33′ or 153′. Actual polar distance greater.

A		*B*	
Log from Table II..	9.75110	Log from Table II..	6.1771
Log 153.....	2.18469	2 Log 153.....	4.3693
(Sum)	1.93579	(Sum)	.5464
Cor *A*.....	86.2′+	Cor *B*.....	3.5′+
Cor *B*.....	3.5′+	Zenith distance (from Table I) .....33°	16.5′
	89.7′+	Corrections ..... 1°	29.7′+
		Zenith distance ....34°	46.2′

Here actual polar distance greater gives an additive Correction *A*, because latitude 25° is below the bar, and *X* consequently less than 90°.

THE THIRD CORRECTION *C*.

We have so far considered only two terms of the series for z, the tabulation of which would enable us to employ a difference of declination of 8°, the values tabulated being 0°, 8°, 16°, 24° north and south, seven values in all. But if we include another term of the series, and thus obtain the logarithm for a third Correction *C*, it would suffice to proceed by a common difference of 12° of declination, as 0°, 12°, 24°, and the total number of values for the declination employed would thus be reduced from seven to five, with a considerable saving in the space occupied.

The next term of the expansion would be

$$\tfrac{1}{6}\frac{d^3z}{dp^3}\sin^2 1'(\Delta p)^3,$$

so that if the values of $\tfrac{1}{6}\frac{d^3z}{dp^3}\sin^2 1'$ are calculated and tabulated we have only to add three times the logarithm of (Δp) to the tabular logarithm to obtain the logarithm of *C*. As three places of decimals are amply sufficient, this is not a very troublesome operation.

TO INVESTIGATE AN EXPRESSION FOR $\frac{d^3z}{dp^3}$.

It has already been shown that

$$\frac{d^2z}{dp^2} = \sin^3 X\left(\frac{\cot c\cos p}{\sin h} + \cot h \sin p\right),$$

and also that

$$\frac{dX}{dp} = -\sin^2 X\ \frac{\cot c\cos p}{\sin h} + \cot h \sin p\Big).$$

Differentiating the first of these expressions,

$$\frac{d^3z}{dp^3} = 3\sin^2 X \cos X \frac{dX}{dp}\left(\frac{\cot c \cos p}{\sin h} + \cot h \sin p\right) + \sin^3 X\left(\cot h \cos p - \frac{\cot c \sin p}{\sin h}\right).$$

But

$$\cot h \cos p - \frac{\cot c \sin p}{\sin h} = -\cot X,$$

$$\therefore \sin^3 X\left(\cot h \cos p - \frac{\cot c \sin p}{\sin h}\right) = -\sin^2 X \cos X.$$

Thus

$$\frac{d^3z}{dp^3} = 3\sin^2 X \cos X \frac{dX}{dp}\left(\frac{\cot c \cos p}{\sin h} + \cot h \sin p\right) - \sin^2 X \cos X,$$

Substituting for $\frac{dX}{dp}$,

$$= -3\sin^4 X \cos X\left(\frac{\cot c \cos p}{\sin h} + \cot h \sin p\right)^2 - \sin^2 X \cos X,$$

$$= -\sin^2 X \cos X\left\{3\sin^2 X\left(\frac{\cot c \cos p}{\sin h} + \cot h \sin p\right)^2 + 1\right\}.$$

The final expression to be tabulated, therefore, is

$$-\tfrac{1}{6}\sin^2 1'' \sin^2 X \cos X\left\{3\sin^2 X\left(\frac{\cot c \cos p}{\sin h} + \cot h \sin p\right)^2 + 1\right\},$$

which has to be multiplied by $(\Delta p)^3$ to give the amount of the correction.

As the amount of Correction C is never very large it will be found to be sufficient to calculate for each 5° of latitude, and interpolate by ordinary proportion. It will suffice also to take three places of decimals only, and to tabulate for each second degree. Interpolation for intermediate degrees could easily be effected at sight.

The negative sign of the correction indicates that C will be of opposite sign to A. In practice, the simplest plan will be to regard C as a deduction to be made from the value of A, and proceed accordingly.

PRACTICAL RULES FOR FINDING CORRECTION C.

Write down the log for Correction C from Table II. Under this write three times $\log(\Delta p)$ in minutes.

The sum, less 10, is the logarithm of C.

EXAMPLES (CORRECTION *C* TAKEN INTO ACCOUNT).

Example 3.—Find the zenith distance of Procyon (Dec. 5° 27′ N.) for H. A. 2ʰ in latitude 25° N.

It will be noticed that this example has been already worked, taking as our starting point declination 8°, and making use of Corrections *A* and *B* only. It will be instructive to work it also with the aid of all three corrections, making use first of the tabular values for declination 0°, and again with those given under declination 12°.

WITH DECLINATION 0°.

The difference of polar distance (Δp) is 5° 27′ or 327′. Actual polar distance *less* than tabular.

A		*B*		*C*	
From Table II..	9.83378	From Table II.....	5.9924	From Table II.....	2.474
Log 327.....	2.51455	2 Log 327....	5.0291	3 Log 327..	7.544
(Sum).....	2.34833	(Sum).....	1.0215	(Sum).....	.018
A.....	223′−	*B*.....	10.5′+	*C*.....	1′+
C.....	1 +	Z. D. from Table I.....	38°17′		
A−*C*.....	222 −	Corrections...	3°31.5′		
B.....	10.5+				
Correction.....	211.5−	Z. D. required	34°45.5′		

WITH DECLINATION 12° N.

A		*B*		*C*	
From Table II..	9.68397	From Table II.....	6.2577	From Table II.....	2.674
Log 393.....	2.59439	2 Log 393....	5.1888	3 Log 393..	7.783
(Sum).....	2.27836	(Sum).....	1.4465	(Sum).....	.457
A.....	189.8′+	*B*.....	28′+	*C*.....	2.9′−
C.....	2.9−	Z. D. from Table I.....	31°10.5′		
A−*C*.....	186.9+	Correction....	3°34.9′+		
B.....	28. +				
Correction.....	214.9+	Z. D. required	34°45.4+		

Thus, proceeding by a wholly different route, we arrive at precisely the same result as before.

For a second example we take a case in the neighborhood of the "bar," which, in the column "Log Cor *A*," in Table II, forms the dividing line between values of *A* in the first and second quadrant.

Example 4.—Find the zenith distance of the sun for H. A. 2ʰ in latitude 10° N. when the declination is 18° N.

Difference of polar distance is 360′. Actual polar distance *less* than tabular.

A		*B*		*C*	
Log from Table II.....	8.17130	Log from Table II.....	6.4081	Log from Table II..	1.333
Log 360.....	2.55630	2 Log 360.....	5.1126	3 Log 360..	7.669
(Sum).....	.72760	(Sum).....	1.5207	(Sum).....	9.002
A.....	5.3′+	*B*.....	33.2′+	*C*.....	.1′−
C.....	.1−	Z. D. from Table	29°30′		
A−*C*.....	5.2+	Correction.....	38.4′+		
B.....	33.2+	Z. D. required..	30°8.′4		
Correction.....	38.4+				

This case may be regarded as a somewhat special one because *A* and *C*, being on the point of vanishing and changing sign, *B*, which is not far from attaining a maximum value, becomes the most important element in determining the amount of the total correction.

It should be remembered that although provision is made in the tables for all three corrections, it is by no means necessary that the whole of these should be taken into account on every occasion. When actual declination, for instance, falls within 1°, or 60′, of the tabular value, both *B* and *C* might very generally be both omitted, especially in the higher latitudes, and *C* need not be included when actual is within 3° or 4° of the tabular value of declination. A moment's inspection of the value for the logarithms of the corrections given in the table should show whether these are worth taking into account. In the example just worked, for instance, although we were employing a difference of polar distance between actual and tabular of 360′, which is a limiting value, the small amount of the "Log for *C*," viz., 1.333, would indicate at once that the resulting value of Correction *B* could only be a small fraction of a minute, and might, therefore, be left out of account.

Roughly speaking, *C* might probably be safely neglected in two-thirds of the whole number of cases.

Some little simplification would result also from the inclusion in the tables of a special table of "Logarithms of Numbers," occupying only a few pages of space. Such a table might furnish at sight the logarithm of a number, the logarithm of its square and of its cube. Risk of errors in multiplication would thus be eliminated.

The form for such a table is exhibited below.

Number.	Log.	Log of Square	Log of Cube.
275	2.43933	4.8787	7.318
276	2.44091	4.8818	7.323
277	2.44248	4.8850	7.327
278	2.44405	4.8881	7.332
279	2.44560	4.8912	7.336
280	2.44716	4.8943	7.341

It will be noticed that in the examples worked our results come out in pairs, that the corrections once determined give us the total correction for an actual zenith distance greater as well as less than the tabular by a given number of minutes.

Example 5.—In latitude 27° N. from the tabular values for declination 0°, find the zenith distances at H. A. 2^h for declination 4° N. and 4° S. respectively.

A		*B*	
Log for Table II....	9.85349	Log from Table II...	5.9359
Log 240.....	2.38021	2 Log 240	4.7604
(Sum)	2.23370	(Sum).....	.6963
A	171.3′	*B*	5′+

A.....	171.3′	For 4° S. (actual polar distance greater).	
	5′	Z. D. from Table I.....	39° 30′
A−*B*..	166.3′	Correction (*A*+*B*)	2° 56.3′+
A+*B*..	176.3′	(Sum) Z. D.....	42° 26.3′
		For 4° N. (actual polar distance less).	
		Z. D. from Table I.....	39° 30′
		Correction (*A*−*B*)	2° 46.3′
		(Difference) Z. D.....	36° 43.7′

The results show that for a given hour angle the increase of zenith distance produced by an increase of polar distance (Δp) will in general be greater than the decrease in zenith distance caused by a diminution (Δp) in polar distance. In the exceptional case, however, when latitude being less than declination and of same name, the angle *X* lies in the second quadrant, the contrary will be the case.

SOME SPECIAL CASES IN THE VALUES OF THE CORRECTIONS.

If the hour angle is 0°, the angle X is also 0°; Corrections B and C vanish, cos X becomes unity and the change of zenith distance is equal to (Δp), the change in polar distance.

Correction B also vanishes if the body is in the horizon, since in that case

$$\cot c \cos p + \cos h \sin p = 0.$$

If $X = 90°$, that is, if the body is at the position of "maximum azimuth," $\cos X = 0°$. In that case A and C must both vanish and the total correction depends upon B. This point has been already illustrated in the work of Example 4.

GENERAL OBSERVATIONS.

A few words may perhaps be added here as to the history of the system of Marcq Saint-Hilaire position-lines, in which this problem of calculating zenith distance plays such an important part. Originally proposed by the late Admiral Saint-Hilaire in the *Revue Maritime*, in July, 1875, the method attracted little attention at the time, or for some years afterwards. Eventually, however, it came to be practiced extensively in the French Navy, and within the last few years it has received official recognition in the British Navy also, to the exclusion of all other methods. Still more recently the advantage of having one simple method of procedure, available in all cases, has come to be recognized more generally, and the practice of the Saint-Hilaire system is to-day steadily gaining ground in the mercantile marine.

Under these circumstances the problem of calculating a zenith distance, which, in the old days, was required chiefly for use in the identification of a star, and which commonly received only a casual degree of attention, and, indeed, in some cases, was not noticed at all in standard works on navigation, has acquired a largely increased amount of importance, so that navigators are naturally not unwilling to consider any device which seems to offer a simplification of the problem.

With regard to the system proposed in these pages the following points may be noticed.

(*a*) The method of procedure, by means of corrections applied to a tabulated zenith distance, is in many ways analogous to the recognized process for deducing latitude from an altitude of the

pole-star, and, with many of the methods for reducing a zenith distance, taken upon a small bearing to the meridian.

(*b*) With the aid of such a table of logarithms of squares and cubes of numbers as has been suggested up to 360, with the logarithms of the numbers continued up to 1000, the whole of the calculations need not involve more than two openings of the tables.

(*c*) The rules for the application of the algebraic signs are of a very simple character, the only point requiring particular attention being the difference between the actual and tabular polar distance, in connection with the sign of Correction *A*, and this involves only a moment's consideration.

(*d*) The summation of only two logarithms at a time is substituted for the customary "long tot." Risk of error in the process of addition is thereby largely reduced.

In view of the growing popularity of the Marcq position-lines, navigators would seem to be standing at a "parting of the ways." They are gradually discarding the ancient methods of fixing position by the direct determination of a latitude or longitude in favor of a system which offers a single solution of the problem, available at all times, irrespective of special conditions of hour angle and azimuth, involving the simple calculation of a zenith distance in all cases alike. The processes offered by the standard text-books leave something to be desired, and amongst the multitude of new methods proposed the mariner will doubtless in due time make his selection and pick out that which is best suited to his needs. The wider, therefore, the field of choice the better.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

REPORT OF THE UNITED STATES JOINT ARMY AND NAVY POWDER BOARD IN CONNECTION WITH AN EDITORIAL IN LONDON *ENGINEERING* OF OCTOBER 6, 1911.

INTRODUCTORY.

Within the last few months a number of editorials have appeared in London *Engineering* criticising the nitro-cellulose powder used in the United States Army and Navy, and claiming great superiority for nitro-glycerine powders, and especially cordite.

One of these editorials, published in *Engineering* of October 6, 1911, was referred for consideration and comment to the United States Joint Army and Navy Powder Board.

The editorial in question is here reproduced, followed by the comments of the Powder Board.

"THE 'LIBERTÉ' DISASTER AND PROPELLENT POWDERS."

EDITORIAL, ENGINEERING, OCT. 6, 1911.

While it would be, to say the least, premature definitely to ascribe the disaster to the French battleship *Liberté* to the spontaneous combustion of the propellent powder on board, there is sufficient justification for some examination of the subject, in view, firstly, of the tendency of naval opinion in France in favour of this theory, and, secondly of the question which has been raised in this country owing to inadequate information, as to the immunity, or otherwise, of our own ships from similar catastrophe. As a court of inquiry is to be held into the case of the *Liberté* disaster, we shall refrain from attempting any investigation of the subject. But consideration can profitably be given to the main points of comparison between the two classes of propellent powder used in the respective navies in order to set at rest any misgivings which may exist in this country as to the likelihood of similar accidents in our own ships. This, too, can

be done without injuring the susceptibilities of our friends in the French service, with whom all sympathise. They themselves, in large numbers, are disposed to attribute the accident to the spontaneous combustion of the powder, as the events immediately preceding the actual principal explosion are reported from reliable sources to have resembled greatly those which occurred in the case of the *Jéna* explosion, which was officially ascribed to the spontaneous combustion of the propellent powder on board. Moreover, it is of much significance that an order has been raised withdrawing from service all the propellent powders of a certain age still in the French ships. If the reports as to the newspaper interview with Admiral Bellue, commanding the Second Squadron, are correct, it would also appear that that officer has no doubts whatever in his own mind that the accident was due to spontaneous decomposition of the propellent powder, in the same way as occurred on the *Jéna*.

In speaking of this powder, it will be noticed that we emphasize the word "propellant" and we do so advisedly, inasmuch as many writers in the daily journals confuse this class of powder with high explosives or shell powders used for destructive purposes. Briefly, a propellent powder is the powder used in the gun for projecting the shot therefrom. Being generally of a colloidal type, the speed of combustion is entirely under the control of the manufacturer, in that it burns from the surface only, and therefore can be manufactured to burn slowly or quickly according to the size of the gun for which it is intended. High explosives however, being designed for use in shells and to do the greatest amount of damage by disruption of the shells containing them, it is essential that their combustion should be as rapid as possible, and if they can be detonated, so much the better; detonation has been defined as "instantaneous decomposition throughout the mass." It is evident, therefore, that a propellent powder would be unsuitable for a shell, whilst a high explosive powder used for filling shells would shatter a gun to pieces if detonated therein. The modern types of high explosives, such as picric acid, trinitrotoluol, etc., are very stable bodies, so no fear need be entertained that they are to blame. Propellent powders, on the other hand, are far more complex, and susceptible to various influences and consequent changes in their characteristics and behavior, which constitute at all times

a certain element of anxiety. It is only by the utmost care in the choice of a propellant and in the manufacture thereof, combined with a most throrough system of periodical inspection, testing, and proper conditions of storage at moderate temperatures, that disasters similar to those which have, unfortunately, occurred elsewhere have been avoided in our Navy.

There is a broad distinction between the types of propellent powders used by Great Britain and France, the one being what is known as the nitro-glycerine type, the other the nitro-cellulose type. Besides Great Britain the following countries use the nitro-glycerine type for their navies: Germany, Italy, Japan, Brazil, Argentina, whilst those which use the nitro-cellulose type are France, the United States, and Russia. It is a somewhat striking fact that, with the exception of Russia, it is the navies that use a nitro-cellulose propellent powder which have had most trouble and accidents. Russia, however, has not had a very severe trial, as her ships mostly lie in cold climates, not being too often at sea, and consequently, with steam up, the magazines are seldom warmed to high temperatures, or, even if so, are not kept at high temperatures for long periods. In all navies magazine cooling has done a great deal towards minimizing risks with either class of powder; but magazine cooling alone is insufficient for safety unless accompanied by a proper system of inspection and testing.

A nitro-glycerine propellent powder consists of an intimate mixture of nitro-cotton and nitro-glycerine, to which is generally added a small percentage of non-volatile matter, the most usual being "mineral-jelly," popularly known as vaseline. The nitro-cotton, of which gun-cotton is a high grade, is mixed with the nitro-glycerine by hand in suitable proportions, generally about two or three parts of nitro-cotton to one of nitro-glycerine, and is then machine-mixed with acetone and mineral jelly, passed through suitable dyes, etc., and finally dried in hot-air stoves. The acetone breaks down the structure of the nitro-cotton, and is said to gelatinize it —*i. e.*, change it more or less into a colloid, and, as the nitro-glycerine and mineral jelly are already colloids, it follows that the resultant mass when squeezed into cords or tubes through suitable dyes, or rolled out into strips, is also colloidal; in other words, the physical state of the finished article is such that combustion takes place only on the surface instead of

penetrating the mass. The mineral jelly also has, so to say, a "water-proofing" effect which preserves the propellant against the deleterious influence of changes in atmospheric conditions, and prevents alterations in the percentage of the residual moisture which it is impossible completely to extract or dry out. This is a most important point, as will be shown presently.

A nitro-cellulose powder consists almost entirely of nitro-cellulose, another grade of nitro-cotton containing less nitrogen than the gun-cotton used in a nitro-glycerine powder. The solvent or gelatinizing agent employed with nitro-cellulose propellants is a mixture of ether and alcohol; acetone will not do, as it makes the finished article too brittle, and, further, would gelatinize it to too great an extent, rendering the powder difficult to burn. Consequently, as nitro-cellulose powders are not of such a colloidal nature as nitro-glycerine powders, and as it is impossible to incorporate mineral jelly with them, they are thus considerably influenced by differences of temperature, moisture, etc., necessitating their storage, in hermetically sealed cases. This is a necessity, from a ballistic point of view, for the reason that even very small fluctuations in the percentage of residual moisture have a very large influence upon the behavior of the powder in the gun, with consequent loss of accuracy in the shooting. On the other hand, hermetically to seal up a case of powder is distinctly deleterious in the long run to the chemical stability of that powder, more particularly in hot climates or in hot magazines; for if the gaseous products of decomposition are not allowed to escape, they have a cumulative effect upon the rest of the powder. It may be here remarked that all modern propellent smokeless powders of the nitro type, being, as it were, in a state of strain, commence a slow, though gradual, decomposition from the moment they are made; consequently, any influence which tends to hasten such decomposition, or which causes a cumulative effect in such decomposition, is to be carefully avoided. In addition, therefore, to keeping modern propellants cool, it is necessary that they should be aërated, and not bottled up in hermetically closed cases, otherwise a time will come when the decomposition will become so accentuated and rapid that the accumulation of the gaseous products of decomposition in the sealed cases will engender sufficient heat to burst into flame. Then, in an enclosed space, such as a ship's magazine, the gases

of the burning powder, not being able to escape sufficiently rapidly, will set up such a pressure as to reach the critical point, when the burning will change to explosion of a violent character and the ship will be destroyed.

In comparing the nitro-glycerine and nitro-cellulose types of propellent powders we have two entirely different sets of factors. With the nitro-glycerine type we have a powder which, from the nature of its composition, is more stable, which can be safely left in non-air-tight cases and allowed to aërate freely, and which is not so subject to the great influence of fluctuations in moisture content, and which, consequently, gives very even shooting results.

On the other hand, a nitro-cellulose powder is inherently less stable, is greatly influenced by fluctuations in percentage of moisture content, with consequent loss of accuracy in shooting, necessitating its enclosure in hermetically sealed cases, which not only prevent its aëration, but also render its systematic inspection and testing much more difficult. From the above considerations it is evident that, at any rate for naval purposes, a nitro-cellulose propellent powder cannot compare as regards stability with a nitro-glycerine propellent powder. The only point in its favor is the claim that it gives less erosion, but this has, in recent years, been found to be based on a wrong premise—viz., that the temperature of combustion of a nitro-cellulose powder being lower than that of a nitro-glycerine powder, the erosion with the former is less. Experiments have shown, however, that erosion is not only a function of the temperature of explosion, but also of other factors which tend to counter-balance the advantage of the lower explosion temperature.

It is somewhat surprising, therefore, to see the French Navy adhering to a powder which offers, apparently, no advantages, and indeed, would appear to be distinctly inferior, from every point of view, to a nitro-glycerine powder, if we are to judge from the experience of those navies which, presumably having tried both classes of powder, decided, for naval purposes, to adopt the nitro-glycerine type. It is interesting to note that Germany, Japan, Brazil, and Argentina, though using a nitro-cellulose powder for their armies, use, so far, only nitro-glycerine powder for their navies. Great Britain uses the latter for both Navy and Army. In any case, even with the more stable nitro-

glycerine powder, a rigid and thorough system of inspection and testing must be carried out, not only during manufacture and on proof, but also during subsequent storage and use in the service. It is satisfactory to know that in no country in the world is such scrupulous care taken in these respects as in this country. We make no apology for referring to two articles on the subject of "Nitro-cellulose Powder for Naval Purposes," which appeared in *Engineering* of August 19, 1911, and May 20, 1910. The latter, written a short time after the *Jéna* disaster, quotes from the "*Memorial des Poudres et Salpetres,*" a French Government Publication, and also from official United States instructions, all of which fully bear out the arguments put forward above in support of our contention that for naval purposes a nitro-cellulose powder is unsuitable, and will possibly be found to be the cause of the terrible accident to the *Liberté,* which we, as a nation, deplore as deeply as our friends in France.

REPORT OF JOINT ARMY AND NAVY BOARD ON SMOKELESS POWDER.

WASHINGTON, D. C.

FROM: Joint Army and Navy Board on Smokeless Powder.
TO: Bureau of Ordnance, Navy Department.
SUBJECT: Editorial London *Engineering,* Oct. 6, 1911, "The *Liberté* Disaster and Propellent Powders."

In accordance with a request from the Chief of Bureau of Ordnance, U. S. Navy, this Board has given careful consideration to the editorial in London *Engineering* of Oct. 6, 1911, (copy prefixed hereto), in which a comparison is drawn between the nitro-glycerine powders used in the British and certain other navies, and the pure nitro-cellulose powders used in the navies of the United States, France and Russia.

NOTE.—For convenience, powders containing nitro-cellulose alone are commonly designated as "nitro-cellulose" powders, and those like cordite and ballistite which contain both nitro-cellulose and nitro-glycerine, by the convenient though inexact term, "nitro-glycerine" powders.

The fact must always be kept in mind, that the so-called "nitro-glycerine" powders contain nitro-cellulose as their principal ingredient; so that all evidence going to prove the instability of nitro-cellulose *as such,* applies with equal force to both types of powder unless it can be shown that the addition of nitro-glycerine has some stabilizing effect upon the nitro-cellulose.

The first point to be noted in the article under consideration is the assumption that all nitro-cellulose powders are of necessity identical, and that to designate the powder used in the United States or elsewhere as a "nitro-cellulose powder" is to describe it completely and to establish its identity with the powder which has given so much trouble in France. As a matter of fact, there are very important points of difference between our powder and that which is supposed to have caused the destruction of the *Jéna* and the *Liberté*.

To begin with, our methods of manufacture, stowage and test are incomparably superior to those which the French authorities themselves describe as having obtained in the French service, and the insufficiency of which might well be held to account completely for the accidents to the *Jéna* and the *Liberté*. Moreover, the standard powder of the United States Army and Navy has for several years past contained a "stabilizing" ingredient which is universally recognized as enormously improving the stability of powders containing it and which, while it is reported to have been recently adopted for French powders, was not contained in any of the powders which have given trouble. Thus it is entirely misleading to discuss our powder as if it were identical with the French powder which was involved in the *Jéna* and *Liberté* disasters.

That the imperfect methods used in France might well be considered as accounting for the accident to the *Jéna* was the view expressed by *Engineering* editorially in commenting upon the destruction of that vessel.

> . . . . it is quite clear that the disaster on board the *Jéna* was due to faulty location of the ammunition magazines and to imprudence generally. From this speech it is evident that the smokeless powders of any nation—and they are all practically the same composition—would have behaved in the same way in similar circumstances.—*Engineering*, October 30, 1908, page 579. Editorial, "Smokeless Powders."

As regards the matter of stabilizers, we start with the fact, now universally admitted, that all types of smokeless powder are subject to some degree of deterioration within the limits of temperature which prevail or may prevail in magazines on shipboard and elsewhere. The question arises, then, whether it is possible to prevent or delay the progress of this deterioration by incorporat-

ing in the powder some substance which shall act as a deterrent of decomposition, thus becoming a "stabilizer" for the powder.

It will be shown hereafter that the alcohol used as a solvent for pure nitro-cellulose powders is very helpful in this direction, especially when the powder is kept in air-tight containers; and that the mineral jelly used in cordite has a similar beneficial action. Within the rather limited scope of the action of these substances, the two types of powder seem to be on approximately an equal footing, if we disregard for the moment the claims made by *Engineering* in the matter of open *vs.* closed containers for stowage. Within the last few years, however, there has been introduced into our manufacture a substance known as di-phenylamine, the stabilizing power of which is several times as great as that of the mineral jelly upon which the English rely to protect their cordite or the alcohol upon which we formerly relied and upon which the French have relied until very recently. This substance has been used in German powders for many years, with complete satisfaction, and our own tests of its efficiency have been entirely convincing. It is believed that powders which in themselves would have a safe life of six or seven years can be confidently counted upon, if containing diphenylamine, for a life of twenty years, and perhaps much more than this.

It is evident that the adoption of this substance marks a new era in the manufacture of smokeless powders and that a sharp distinction must be drawn, in all discussions of stability, between those powders which do, and those which do not, contain diphenylamine; that is to say, so far as United States powders are concerned, between those made prior to 1908 and those made since that date. With regard to the former, there is good reason to believe that with the system of inspection in use, they are perfectly safe for a longer period of time than that for which they are trusted in practice, this period being much shorter than that which would be safe with the present powders. We believe it to be well established by the evidence which will be cited in the later pages of this report, that these earlier powders, made of pure nitro-cellulose and without diphenylamine, are superior in stability to nitro-glycerine powders which are also made without diphenylamine. In view, however, of the fact that a diphenylamine powder has been the standard of the United States Army and Navy for several years, no other powder having been manufactured

during that time, it is manifestly unfair at this date to speak of the earlier powder as if it were the present standard; and it is hardly to be supposed that even critics as prejudiced or as imperfectly informed about our earlier powder as we believe the writer in *Engineering* to be, would condemn our present powder as unsafe.

So far as navy powders are concerned, the policy is to retire the earlier powders as rapidly as is convenient, and replace them by the new type; not because the older powders are bad, but because, however good they may be, they are inferior to the newer ones.

The older powders are "re-worked," by a process which makes them new in every sense of the word, diphenylamine being incorporated in the course of the process. It is important to emphasize the fact that this reworking has nothing in common with the very superficial "radoubage" used by the French in an attempt to restore the stability of deteriorated powders. The French process consists in little beyond the adding of solvent to replace that which has evaporated. Our process begins with a complete physical disintegration of the colloid, by pulverizing, reducing it to finely divided nitro-cellulose, which is then started upon the same course of thorough purification to which the nitro-cellulose is subjected in original manufacture, no single step of boiling or washing being omitted. In fact, the only steps of the original manufacture which are omitted from the re-working are the nitration of the cotton and the steps preliminary to nitration. Diphenylamine is introduced exactly as in new manufacture, and the resulting product is, in the fullest sense of the term, a *new* powder; *not* an old powder modified.

The above description of our re-working process constitutes a reply to certain criticisms of what was assumed to be the process, which have appeared in *Engineering* since the article with which we have been chiefly dealing in the present paper. The later article, which appeared in the issue of *Engineering* of Nov. 3, 1911, starts with the assumption that our process of reworking is a mere attempt, like that of the French, to bolster up a bad powder, and with this assumption, *Engineering* proceeds to point out the error of this policy and to predict disaster as a result of it. This is reasonable enough as applied to "radoubage," but has no application whatever to our process.

While it will be seen from what precedes that the strictures of *Engineering*, in the article now under consideration, in so far as they apply to our present powder, are valueless because based upon entirely false assumptions as to the nature of the powder, we believe that these strictures could be successfully refuted on the broader ground that nitro-cellulose powders as such are inherently safer than nitro-glycerine powders—assuming both to have been made with equal care.

It will be interesting in this connection to note certain opinions heretofore expressed by *Engineering*, when it did not feel called upon to reassure an anxious public with regard to the safety of cordite; and when, also, the question of British *vs.* United States powder was not under consideration by South American powers having large contracts for war material to be placed either in England or in the United States.

On November 18, 1888, Sir Hiram Maxim took out Patent No. 16,213, for a smokeless powder made of pure tri-nitro-cellulose of the highest degree of nitration, and also apparatus for manufacturing the powder. This gun cotton was dissolved or softened in ether, alcohol and acetone, and then formed into grains of varying sizes, this composition being the identical powder which is now used in the United States of America and made in the same way. They have used it ever since they abandoned the nitro-glycerine compound. It is a very stable powder, and perhaps, everything considered, is the best possible class of smokeless powder.—*Engineering*, January 27, 1911, page 125. Editorial, "Naval Ordnance and Smokeless Powder."

All nitro powders being highly exothermic chemical compounds, in place of a mere mixture of reagents, such as common black powder, are much more liable to deterioration when stored under high temperature. The disastrous explosion on board the *Jéna* will be in the minds of all, and our own Navy and Army have also suffered from this unfortunate characteristic of the modern type of propellant, though fortunately, on a much less serious scale.—*Engineering*, June 14, 1907, page 780. Editorial, "The Cordite Debate."

In December 1899 a six-inch cartridge on the Revenge ignited spontaneously, and two other cartridges in the same box were also found to have gone off. In the autumn of last year, moreover, there were two spontaneous explosions at Cordite Magazines in India. The spontaneously ignited ammunition cannot be represented as the natural outcome of a contractor's "greed for dividends," but was actually manufactured at Waltham Abbey under the supervision of officials as to whose complete honesty there is absolutely no question.—*Engineering*, June 14, 1907, page 780. Editorial, "The Cordite Debate."

. . . . . All ships in the German Navy were fitted with apparatus to keep the magazine cool, but our Admiralty only seem to have appreciated the

importance of this during the past year, when the matter was forced on the attention of the Government by the accident on H. M. S. *Fox*, though several years previously a similar accident had occurred on H. M. S. *Revenge*. In both cases by a simple chance, the loss of the ships and their crews, fortunately, did not occur.—*Engineering*, September 27, 1907, Editorial, "Back-flash from Modern Smokeless Powder."

. . . . it has long been recognized that some cordites decompose slowly, and might finally ignite and explode spontaneously. The change is due to the absorption of oxygen from the air, O combining with N of cordite. In order to watch this gas absorption, about 50 grams of cordite are placed in an inverted glass cylinder, which a long bent gas tube connects to a mercury column pressure gauge; the apparatus, without the gauge, is placed in a water bath kept at 70° C. After a while the gas absorption passes into a gas evolution and expansion. The new method is the only reliable one which gives a timely warning that the sample of cordite is not to be trusted; and it is to be hoped that it will prove a safeguard against spontaneous explosions in powder magazines, especially in the tropics.—*Engineering*, June 22, 1911. "New Stability test of Cordite by Dr. Silberrad."

. . . . The usual objection put forth to the introduction of the nitro-cellulose powder is that it will not keep on foreign stations with variable climates. This I must state is erroneous—I have results of nitro-cellulose powders stored in some of the hottest climates, and these have proved in every way satisfactory, both chemically and ballistically, when fired in guns. Some of the great German chemists have had this powder under various heat tests for many years and have reported to me their definite opinion that nitro-cellulose powders, if properly made, are to be relied upon not to deteriorate any more than cordite and other nitro-glycerine powders when subjected to variable climatic influences.—*Engineering*, March 8, 1901, page 297. "Modern Artillery" by Lieutenant A. T. Dawson.

(See fuller quotation from this article in note I of the appendix hereto, together with note II, quoted from an editorial in *Engineering*, March 15, 1901, endorsing and commending Lieutenant Dawson's article.)

The most important considerations in determining the best composition of powder are (a) keeping qualities and safety under normal climatic conditions, (b) capability of highest possible ballistics, (c) regularity in results not to be seriously affected by change of climate, or not to cause excessive erosion. *All* these qualities are secured by the use of the properly manufactured nitro-cellulose powder, and *none* can be said to be met by any powder containing nitro-glycerine.—*Engineering*, Aug. 16, 1901. "Naval Ordnance," by Lieutenant A. T. Dawson, R. N.

(See fuller quotation from this article in note III of appendix hereto.)

To the above very conclusive testimony given by *Engineering* itself as to the instability of cordite, we add a few items from other English technical journals.

As a result of the terrible explosion on board the French battleship *Jéna* there has since been a thorough overhauling of the explosives stored

in the various arsenals and magazines in the United Kingdom, and large quantities of them have been condemned and are being destroyed. Similar measures were taken quite recently in India, being prompted by the deterioration of much of the cordite and other explosives that had been stored in the Indian arsenals and ordnance stores and which had resulted in several serious explosions and outbreaks of fire.—*United Service Gazette* (English), Oct. 31, 1907.

. . . . As all our readers are aware, cordite deteriorates with storage, and more quickly when subjected to changes of temperature. *Army and Navy Gazette*, June 15, 1907. "Cordite Scare."

All cordite of lots K. 408, size 30 and D. 887 size 45 M. D. is to be destroyed.—*United Service Gazette*, December 24, 1908.

Mr. Craig asked whether several recent deliveries of cordite for big guns supplied by the government factory and private manufacturers had been found too unstable after 40 days storage to warrant admission with safety into the service; and, if so, what steps were being taken to provide a stable explosive for the Navy?

Mr. M'Kenna replied, "It is not in the public interest to give the information asked for in the first part of the question. Investigation and experiments are continually in progress *with a view to further insuring the stability of cordite*."—*United Service Gazette*, May 5, 1910.

Coming now to a somewhat more detailed consideration of the points made by *Engineering* in the editorial of Oct. 6, the following assertions are noted as calling for remark: 1st., that nitro-cellulose powders are inherently less stable than nitro-glycerine powders; 2nd., that all smokeless powders are less subject to deterioration when freely exposed to the air than when enclosed in air-tight containers; 3d., that cordite is less subject to changes in contained moisture because it is to a large extent "water-proofed" by the mineral jelly which it contains, and that, as a result of this characteristic it may be, and actually is, carried on British ships in packages which permit free access of air; 4th., that the navies which use nitro-cellulose powder are those which have had most accidents from decomposition of powder.

The general subject of the decomposition of smokeless powder is too technical to be considered very fully at this point. The opinions of experts are quoted at considerable length in the papers appended to this article, and references are there given to other sources of information. We believe that an overwhelming proportion of the evidence available is in favor of the greater stability of nitro-cellulose powder.

It appears to be well established that nitro-cellulose, even when perfectly pure, has some tendency to decompose even at ordinary

temperature, and that this tendency increases as the temperature rises, becoming very marked, and increasing very rapidly, as we go above 90° F. Disregarding for the present the manner of stowage (whether with or without free access of air), this tendency is common to all powders, including cordite, which have nitro-cellulose for a base; and we find no evidence tending to prove that the tendency is checked by the presence of nitro-glycerine, or even that nitro-glycerine is, by itself, more stable than nitro-cellulose. Exactly the opposite appears to be demonstrated by the published results of researches at the Royal Arsenal Woolwich, which indicate that both heat and moisture—the two great enemies of smokeless powder—*produce more rapid decomposition of nitro-glycerine than of nitro-cellulose.*

(See note IV appended: "Nitro-cellulose versus nitro-glycerine," by Robert Robertson, of the Royal Arsenal, Woolwich.)

(See also note V appended: "The Hydrolysis of nitro-cellulose and nitro-glycerine," by Oswald Silberrad and Robert Farmer of the Royal Arsenal, Woolwich.)

Moreover, even the nitro-cellulose itself which enters into the composition of cordite differs from that used in nitro-cellulose powders, and in a direction which makes it distinctly less stable. The material used in cordite is more highly nitrated than that used in nitro-cellulose powders as manufactured in the United States; and is, for this reason, harder to purify, and less stable when it is purified. On this point the researches of Will and Jacques are conclusive, and are fully accepted by English authorities, as proving that the instability of nitro-cellulose increases directly with the degree of its nitration.

See "Nitro-cellulose; Researches on the stability of," by W. Will, *Journal of the Society of Chemical Industry.* Dec. 15, 1902.

Also "Treatise on Instability of Nitro-cellulose," by M. Jacques. *International Chemical Congress* (Rome) 1906. Also note VI appended to this paper giving an abstract of the above paper by Jacques.

It is manifestly impossible that the mere mechanical mixture, without chemical action, of two unstable substances, can produce a substance more stable than either ingredient; and as both the nitro-cellulose and the nitro-glycerine used in cordite are individually less stable than the less highly nitrated material used in United States powders, it is manifest that the mixture of these substances (which differs from cordite only in its form and in the absence of mineral jelly) is at a marked disadvantage

as compared with the nitro-cellulose of lower nitration, used, by itself, in United States powders.

A mixture of nitro-cellulose and nitro-glycerine such as is described above, without other solvents or stabilizers, is the explosive commonly known as "explosive-gelatine," or "blasting-gelatine." It differs from cordite in its form, which is that of a stiff jelly, and in the fact that it lacks the 5% of mineral jelly which acts as a stabilizer in cordite. The two substances have, however, very much in common, and are usually grouped together by writers on stability, as for example in the following very significant quotation from a recent work by Oscar Guttman, one of the highest authorities on the Chemistry of Explosives.

After referring in strong language to the inherent instabilty of nitro-cellulose, the author proceeds:

> . . . . No wonder that when nitro-cellulose is mixed with another explosive like nitro-glycerine to form smokeless powder it becomes less reliable, and acts detrimentally on the nitro-glycerine. This is accentuated still more in the presence of another disturbing factor such as heat or an alkali. I have seen cases of gelatine dynamite literally dripping with nitro-glycerine because a small quantity of ammonium carbonate, added as a so-called stabilizer, caused a decomposition of some of the nitro-cellulose, and this went on to such an extent that the absorbing power of the nitro cotton was destroyed.—*Twenty Years Progress in Explosives*, page 61.

It would seem to be clear from what precedes that cordite without its 5% of mineral jelly would be a very unstable substance. In fact, the stabilizing effect of mineral jelly, which had not before been suspected, was discovered through the alarming instability of certain lots of cordite from which this substance had been omitted.

The material of which our nitro-cellulose powders are made is comparatively stable in itself, and we have, associated with it even in our older powders—those which preceded the introduction of diphenylamine—a stabilizing agent which is at least as helpful as the mineral jelly used with cordite. This is the alcohol which remains in the powder after drying and persists almost indefinitely.

The direct action of the mineral jelly of cordite is, like that of the alcohol in nitro-cellulose powders, to neutralize the acid products of decomposition; but *Engineering* claims that it has a secondary and very important effect in that it forms a water-

proof coating on the outside of the powder grain and thus assists to keep the moisture of the grain from variations due to heat and dampness. It results from this, according to *Engineering*, that there is no necessity for keeping cordite in the air-tight containers which are used with nitro-cellulose powders, the disadvantages of which are that:

"hermetically to seal up a case of powder is distinctly deleterious in the long run to the chemical stability of the powder, more particularly in hot climates or in hot magazines; for if the gaseous products of decomposition are not allowed to escape, they have a cumulative effect upon the rest of the powder."

There is much reason to believe, although the demonstration lacks completeness, that such accelerated decomposition as is described above would actually take place under some conditions with non-colloided nitro-cellulose; that is to say, with pure nitro-cellulose, unassociated with the substances which are associated with it in smokeless powder.

Here we should have a tendency, which might conceivably prove a controlling tendency, for the acid products of initial decomposition to act by catalysis and produce further decomposition.

In the case of the finished nitro-cellulose powder, however, another and very important factor enters into the matter. This is the vaporized alcohol with which the sealed container is filled. This alcohol is a neutralizing agent for the acids of decomposition, and is thus, as has been noted above, a stabilizer for the powder. By the use of air-tight containers we insure the retention of the alcohol in contact with the powder, in quantity far more than sufficient to take care of such incipient decomposition as may develop.

Experiments have shown, moreover, that the pressure of the free gases within the closed container checks the evaporation of the alcohol from the powder and retains it *in the grain*, where its stabilizing effect is of maximum value.

This view of the effect of sealed containers upon the stability of powders made with an ether-alcohol solvent, has been very completely demonstrated by the eminent French scientist L. L'heure, the associate of M. Vielle, in an elaborate series of experiments which are fully recorded in the "*Memorial des Poudres et Salpetres*" No. XV, pages 1-38. (See note VII in appendix to this paper).

These experiments indicate clearly that nitro-cellulose powders, at least, when heated in closed tubes, retain their stability much longer than the same powders heated in open tubes with free access of air.

It is not demonstrated that the same is true of cordite; but if it is not, the question may well be asked, what is the status of the cordite which, in "fixed ammunition," is hermetically sealed up in cartridge cases? There are no statements which indicate that this powder is regarded by the British authorities as more dangerous than that which is put up in other containers. Moreover, the fact seems to be, as will be shown hereafter, that *Engineering* is in error in believing that even the large caliber charges of the English Navy are kept in containers which permit free access of air.

The statement that cordite can be carried, and in the British Navy *is* carried, is such a way as to permit free circulation of air, appears to be contradicted by the following extracts from the official "Handbook on Ammunition 1909—published by Authority of the Lords Commissioners of the Admiralty":

P. 41. Service ammunition is not to be passed for exercise, and is to be handled with great care. The ammunition boxes are packed in dry air, and should therefore only be opened when absolutely necessary.

P. 47. Rough usage of ammunition cases and their contents is calculated to cause mis-fires, hang-fires, or even premature explosion, and, further, ammunition boxes so handled cannot be expected to retain their air-tightness or the contents of their efficiency.

P. 48. The lids are made water-tight by well luted jute yarn, or hemp placed in the groove with more luting placed round the lid.

P. 48-49. Cylindrical cases are made of brass. The lids of all are made water-tight by being screwed up against a dermatine washer fixed by India-rubber solution. Air test plugs are fitted in the lid.

P. 49. Rectangular and cylindrical cases are now being manufactured with weakened ends, so that in case of premature ignition of the cordite charges the gases generated will burst open the cases and explode into the magazine, thereby minimizing the risk of an explosion.

P. 50. Outfit boxes for 6-inch, 4.7 inch Q. F. etc., guns are of teak, zinc lined. The box is made air-tight by luting placed in a recess round the lid.

P. 51. Boxes for 6-pdr. and 3-pdr. are made air-tight by luting the groove round the top edge.

P. 55. The luting which is used for making water-tight rectangular, and metal lined powder cases, and all Q. F. ammunition boxes, and for other purposes, such as making gas tight large base fuzes, etc., is composed of 80 parts of whiting, 20 of vaseline, and 1 part of castor oil.

It would appear from the foregoing extracts that cordite as used in the British Navy is carried in air-tight cases much like those used in the United States Navy and is subject to the same alleged danger of accelerated decomposition to which United States powders are exposed if the views of *Engineering* are correct.

The fact is, however, as has been already shown, that confinement in air-tight cases does not hasten but on the contrary greatly retards decomposition, and that Great Britain and all other powers which keep their powder in air-tight containers act wisely in so doing.

In this immediate connection, a recent experience of the United States Army Ordnance Department is interesting. A large quantity of small arms ammunition loaded with nitro-glycerine powder, having become obsolete because of changes in the service bullet and rifle, was to be broken up.

Examination showed that many of the necks of the cartridge cases were split, bringing the powder in contact with the atmosphere. In all such cartridges the powder was found to be in an advanced stage of decomposition while the cartridges which were intact and thus air-tight were in comparatively good condition.

It is probably true that the mineral jelly used in cordite does perform a useful function in closing the pores of the grains, thus making them comparatively impervious to moisture. We are inclined to believe that this is the one and only point of the article in *Engineering* which is well taken. Evidently, the effect of this is not what *Engineering* claims, for, as has been shown by quotations from the "Handbook of Ammunition," the cordite used in the British Navy is *not* kept open to the air. We believe, however, that the so-called "water-proofing" effect of the mineral jelly is a real advantage and that it cannot fail to be in some measure favorable to stability. This is the more fortunate because of the very rapid decomposition which has been shown to result *in cordite* from the presence of moisture. (See note V in appendix, on "The Hydrolysis of Nitro-cellulose and Nitro-glycerine.")

It is evident that without this water-proofing effect, the life of cordite would be extremely short when subjected to a moist atmosphere.

As the hydrolysis of nitro-cellulose is much less rapid, there is not the same necessity for "water-proofing," although it is quite possible that such an effect would be advantageous if it could be obtained without the sacrifice of other desirable qualities.

The claim that cordite is a tougher colloid than nitro-cellulose powder will not stand for a moment. The comparison is easily made and has often been made. The toughness of our powder is so great that if a grain of it is cut to a length equal to its diameter and subjected to compressive strain, it can be reduced to one-half its original length before a sign of cracking appears on the surface.

The following further extracts from the same British Naval "*Handbook on Ammunition*" which has been already quoted, call attention to another and very serious danger in connection with cordite, which alone should be sufficient to condemn it. This is the danger of *detonation* by shock—a danger which is here officially recognized as existing when the powder is in perfect condition, and which is, of course, enormously increased when the nitro-glycerine has exuded and collected, as nitro-glycerine pure and simple, with all the sensitiveness which is inherent in it, on the outside of the grains or the bags, or within the containing tanks and boxes.

P. 14. Susceptibility. Cordite of small diameter and in short lengths is very susceptible to explosion by concussion; this susceptibility diminishes as the diameter and length increase.

P. 14. Exudation. Cordite sometimes has the surface moist; this condition is called sweating. This is due to the exudation of nitro-glycerine, which is liable to take place when the cordite has been subjected to temperature below 45° F., and subsequently warmed. Below 45° F., the nitro-glycerine freezes, and crystalizes out on the surface, and the melting of these crystals forms the sweating.

P. 14. Sweating does not injuriously affect the cordite, and if it occurs in made up cartridges no action need be taken, but if it appears on cordite in bulk, the cordite is not to be handled till it recovers its normal state, which it will do if its temperature is kept above 45° F., by the reabsorption of the nitro-glycerine; when this has taken place it is serviceable.

If these statements or their significance needed confirmation, abundant testimony like the following could be adduced.

. . . . The great danger that arises from the storage of this nitro-glycerine series of explosives is that at a temperature which may be easily reached, and, indeed, can only be avoided by special precautions

in hot countries, nitro-glycerine will drain out of the mass and form an extremely dangerous residue . . . . .

. . . . The results are in accordance with what might reasonably be anticipated—the experiments certainly appear to bear out the contention that a great percentage of nitro-glycerine is very dangerous. It is said that as it exudes from the powder it collects on the cartridge cases or vessels in which the powder is contained, and may detonate at any time when exposed to shock . . . . .—*Engineering*, April 2, 1897, page 451, "Maxim's Testing Apparatus for Smokeless Powder."

The cordite which was in use at the above date contained a much larger percentage of nitro-glycerine than the present English service powder, "Cordite M. D." The difference, however, so far as the above phenomenon is concerned, is one of degree only, not of kind.

As to the statement that the navies which have had most trouble and accidents are those which use nitro-cellulose powders. It is not clear from the context whether the reference to accidents with nitro-cellulose powder has to do with "flare-backs," or only with accidents arising from the lack of stability of the powder; but as all other parts of the editorial in question relate to the matter of stability, it seems fair to assume that this part refers to the same subject. Viewed in this light, the association of the navies of France and the United States in a sweeping generalization as to accidents is hard to understand.

It has been very commonly assumed in England and on the continent, that the destruction of the *Maine* was—or may have been—due to smokeless powder. The fact is that there was no smokeless powder on the *Maine*, except a small quantity of small-arm ammunition which was in one of the magazines which did not explode. The United States Navy did not issue a smokeless powder for any guns except small arms until after the war with Spain. Recent evidence, moreover, has definitely fixed the cause of the destruction of the *Maine*.

The notable accidents, then, in which ships have been destroyed, presumably by smokeless powder, stand as follows:

Aquidaban, destroyed by *cordite*.
Jéna, destroyed by *nitro-cellulose powder*.
Mikasa, destroyed by *cordite*.
Liberté, destroyed by *nitro-cellulose powder*.

The accidents in the magazine of the *Revenge* and the *Fox*, due to the decomposition of cordite are referred to in articles already quoted from *Engineering*. Commenting further upon these and other accidents, and comparing cordite with the nitro-glycerine powders used in the German navy, *Engineering* says, editorially:

So far as keeping qualities are concerned, the German powder is even better than our cordite. This is also an important factor in view of the cordite explosions which have taken place in the magazines of British war vessels, fortunately, so far, without loss of life or of a ship; similar good fortune may not continue. The report on these explosions has been kept extremely quiet so that is is difficult to speak more fully of them; but on one occasion it was mere good luck that a battleship was not sunk with all hands. Owing to this immunity from disaster, the public have not had their faith in the safety of ships in our fleet shaken in the same way as France quite lately was rudely awakened from the confidence in the excellence of the propellent powder used in her Navy by the terrible disaster on the *Jéna.—Engineering*, Sept. 27, 1907.

It may be remarked in passing that the German powder which is referred to with so much approbation in the above editorial relies for its stability upon the same ingredient "diphenylamine" which is now used in all United States powders.

Apart from accidents on shipboard, the history of cordite and its allied explosives containing nitro-glycerine is filled with incidents like the following, extracted from the official reports of the British Inspector of Explosives:

Report of 1902:

Spain—On June 26th the school of gunnery magazine at Carabanchel camp exploded, killing two men and injuring fourteen others. There were several nitro-powders in the magazine and the explosion is attributed to the spontaneous ignition of unstable ballistite.

Report of 1904:

Fire in blending house in which were present 2300 pounds of cordite. No person was present in the house at the time.

Report of 1904:

Australia—Great excitement at Coolgardie on May 19th when a twenty ton licensed magazine blew up. There are strong grounds of suspicion that the explosion was due to the spontaneous ignition of some nitro-glycerine explosives.

Report of 1905:

A magazine belonging to the Thames Storage (explosives) Company Limited, in which a quantity of small-arm nitro-compound had been kept

for considerable time was burned to the ground. The fire was most probably due to spontaneous decomposition.

Report of 1909:

On September 21st an ignition of cordite M. D. occurred in the magazine of the Small Arms Ammunition Factory, Kikee, India. The fire was attributed to the spontaneous ignition of the cordite, M. D., but no reason for this could be assigned.

Report of 1907 (Inspector in India):

The two explosions of cordite which occurred at Hyberdad on the 7th and 15th of April, 1906, and at Ferozepore on the 31st of August, 1909. Special boards of investigation arrived at the conclusion that the explosions were due to the spontaneous ignition of cordite from some cause or other. Below is given a record of nitro-compound explosions which have occurred in India previous to the explosions of cordite referred to above.

In 1888	explosion	of	two magazines.
In 1890	"	"	one magazine.
In 1891	"	"	one "
In 1896	"	"	one "
In 1898	"	"	two magazines.

All these explosions were attributed at the time to the spontaneous ignition of blasting gelatine owing to chemical deterioration.

Report of 1899:

An accident in the manufacture of cordite occurred at the factory of Kynoch at Holehaven. Some cordite which was being examined on a table took fire and ignited a considerable quantity of the same explosive which was present in the building. An exhaustive inquiry failed to reveal any cause to which the ignition could be attributed with any degree of probability.

It is probable that the above partial list of accidents could be more or less completely duplicated from the history of French nitro-cellulose powders, which are now known to have been manufactured, stored and tested with so little care that they have practically nothing in common with our powder except the fact that they contain no nitro-glycerine.

The chief significance of the above list lies in the evidence which it affords that cordite has no claim to the immaculate record which *Engineering* has been moved to assign to it at this late day, after many years of such condemnation as has been illustrated in various quotations already given.

The experience in this country with cordite and other nitro-glycerine powders has not been such as to inspire confidence in their stability. A large quantity of cordite purchased with the

"*Albany*" and "*New Orleans*" was destroyed as unsafe within a few years after its arrival. The exact dates are not at hand, but the life of the powder was much less than ten years.

Approximately 70,000 pounds of cordite purchased in England in 1898 by the U. S. Army, made up into charges for the 4.7-inch and 6-inch Armstrong guns, was destroyed at Picatinny Arsenal in 1908, it having become so unstable as to be in a dangerous condition. Its condition was indicated by the fact that it gave a KI starch test of only four minutes at 82° C., and that it gave dangerously high and irregular pressures in firing.

A further important feature of our experience with cordite and other nitro-glycerine compounds is that when decomposition does set in it proceeds much more rapidly than in the case of nitro-cellulose powders. And, what is of still greater importance, that *the decomposition is much more likely to terminate in an explosion.*

The gradual progress of such decomposition as may occur in nitro-cellulose powders is one of the most satisfactory guarantees which could be wished, that the change will be detected by the very complete tests which are a matter of routine, long before it can become dangerous. Nitro-glycerine powder, on the other hand, after remaining apparently unchanged for a considerable length of time, is apt to develop instability quite suddenly and rapidly. We have just had a confirmation of this in the case of some nitro-glycerine powder at Frankford Arsenal. This powder showed no marked change in stability from the date of manufacture in 1900 until March of this year. Between March and November, however, it lost stability very rapidly and was destroyed. In March it withstood the 135° C. test for seven hours without exploding and gave a surveillance test at 80° C. of 16 days. In November, five samples exploded in less than two hours at 135° C. and the surveillance test at 80° C. had dropped to seven days.

A similar case of very sudden deterioration in a nitro-glycerine compound is mentioned by J. B. Henderson and T. McCall in an article published in the *Journal of the Society of Chemical Industry* for March 15, 1910. This is the case of a lot of blasting gelatine manufactured Feb. 4, 1909.

On Sept. 9, 1909, this lot was tested and found to be in good condition. On Dec. 15, it was in a dangerous condition, decomposition having set in accompanied by exudation if the nitro-glycerine.

While our experience with nitro-cellulose powder has not been absolutely uniform, it has included but four incidents in which suspicion has fallen upon the stability of the powder. Three of these go back to the very infancy of the manufacture in this country, and the powders involved had been made by methods which were discarded almost immediately afterward. The fourth accident was a fire originating in a powder charge which was being handled at the New York Navy Yard in transfer from the *Culgoa*. No evidence has ever been found that the powder was at fault, and prolonged experiments with a large number of samples of the same powder with the same history, have failed to develop any indication of instability. We have on hand at present many lots dating from the first few years of our manufacture of smokeless powders, about 1900, which are still in good condition.

Within the current month (December, 1911) reports have been received from a number of lots of powder manufactured in 1898 which were sent to Culebra, West Indies, in 1902 and of necessity stored for a number of years in a way which represented very nearly the maximum of unfavorable conditions as to heat and moisture, being subjected to extreme alternations as regards both of these factors. For the first year it was kept in a leaky coal barge, painted black, exposed to the sun, without ventilation; and thereafter, for about 8 years, in a hot and damp underground magazine.

This powder has recently been returned to this country and has been examined at the Fort Mifflin Magazine. A considerable part of it is still in good condition. Several lots, however, which show signs of having suffered more than the others from exposure to moist heat, have decomposed into a pasty mass which deliquesces upon exposure to the air. Not only did none of this powder explode as a result of decomposition, but there is no evidence of any marked rise in temperature having taken place. This evidence is a strong confirmation of the statement already made, that the disposition of nitro-cellulose powder when it does deteriorate is to do so with comparatively slow evolution of heat

and with *little or no tendency to explode.* It also confirms the claim that, in general, our powders—even those which contain no stabilizer—retain their stability for long periods in spite of unfavorable conditions.

The writer in *Engineering* alludes to the matter of *erosion* but dismisses it as if it were of little consequence, with the remark that: "experiments have shown that erosion is not only a function of the temperature of explosion but also of other factors which tend to counterbalance the advantages of the lower explosion temperature."

It is doubtless true that other factors than temperature have their effect upon erosion, but these effects are comparatively trifling, and even at that, there is no evidence that they are less important in cordite than in nitro-cellulose powder. All authorities agree that, broadly speaking, erosion is a direct result of the temperatures to which the bore of the gun is subjected by the combustion of the powder charge, and all authorities are equally agreed that this temperature is something like 50% greater with cordite than with nitro-cellulose powder.

There have been no experiments since those of Sir Andrew Noble, in 1900, which have thrown any doubt upon the *results* which he records in the following words:

> From the curve showing the quantities of heat you will note that in passing from 10% nitro-glycerine to 60%, the heat generated has increased by about 60%. But if you will examine the curve indicating the corresponding amount of erosion, you will see that while the heat is only greater by about 60%, *the erosion is greater by nearly* 500 *per cent.*
>
> These experiments entirely confirm the conclusion at which I have previously arrived; viz., that heat is the principal factor in determining the amount of erosion.

It should be noted that these experiments cover a range which begins far below the percentage of nitro-glycerine in cordite M. D. (30%) and ends slightly above that of the orginal cordite (58%).

The following editorial in *Engineering* under date of March 15, 1901, gives some interesting facts with regard to the erosion resulting from the use of the unmodified cordite of that day, with its 58% of nitro-glycerine:

> Cordite is the powder in use in all our guns, and it has had its trial in the South African war. What are the results? It is no secret that

the erosion with cordite is most excessive, and we believe that this is even with guns not designed to give the highest energies now necessary in modern artillery. We understand that many of our field pieces in the Transvaal have been returned "badly eroded," and, further, that many of the 4.7-inch guns in the Transvaal, supplied by the Navy from Simon's Town, had to be replaced, owing to the wear in the bore quite spoiling the shooting. As an instance of the irregularity, we may mention that the firing of the 4.7-inch gun varied in range by over 400 yards. This fact alone demonstrates to the country the serious peril involved in continuing the use of cordite. It is obvious that if these disadvantages are now appearing in the present conflict, in which but a comparatively small number of guns are being utilized, a very lamentable position would be created if we were at war, say, with two first-class maritime powers, in which the long range and the efficiency of the guns must practically control the final result. It surely is a very short-sighted policy not to take active measures when such facts are well known.—*Engineering*, March 15, 1901, "Smokeless Powder."

A comparative study of nitro-glycerine versus nitro-cellulose powders from the point of view of erosion has recently been made by the Ordnance Department of the United States Army, with results which fully confirm those obtained by the British authorities already quoted. These firings were made in 1907 with the 30-caliber rifle. Two of the powders used contained 20% and 30% of nitro-glycerine (the larger per cent being practically that which is incorporated in the latest British powder, cordite M. D.).

The accuracy-life of the rifle was found to be as follows:

With 30% nitro-glycerine powder .. 2000 to 3000 rounds
With 20% nitro-glycerine powder .. 3000 to 4000 rounds
With nitro-cellulose powder ..... 12,000 to 15,000 rounds

After 2000 rounds, the mean absolute deviations at 1000 yards of the rifles using the different powders were as follows:

With nitro-cellulose powder ..... 15.2 inches
With 20% nitro-glycerine powder ..... 16.6 inches
With 30% nitro-glycerine powder ..... 26.6 inches

After 3000 rounds, the deviations increased to the following:

With nitro-cellulose powder ..... 15.7 inches
With 20% nitro-glycerine powder ..... 18.6 inches
With 30% nitro-glycerine powder ..... 37.4 inches

After 4000 rounds, the deviations increased to the following:

With nitro-cellulose powder ..... 16.3 inches
With 20% nitro-glycerine powder ..... 26.5 inches
With 30% nitro-glycerine powder .....Accuracy entirely lost, rifling practically destroyed.

After 5000 rounds, the deviations were:

With nitro-cellulose powder ..... 16.9 inches
With 20% nitro-glycerine powder .....Accuracy entirely lost, rifling practically destroyed.

After 15,000 rounds, the deviations were:

With nitro-cellulose powder ..... 24.5 inches

Thus the rifle using nitro-cellulose powder was in better condition after firing 15,000 rounds than the one using 30% nitro-glycerine after 2000 rounds and better than the one using 20% nitro-glycerine after 4000 rounds.

The two series of experiments above described, by Sir Andrew Noble and the United States Ordnance Department, are the only ones with which the Board is acquainted in which the firings were pushed to a final conclusion, and it will be observed that the results of the two series are in substantial accord, and that they agree entirely with the view expressed by *Engineering* in the article just quoted from the issue of March 15, 1901.

The claim has been made in the preceding pages that there are good and bad nitro-cellulose powders, just as there are, doubtless, good and bad nitro-glycerine powders; and that the powders which have caused the recent terrible disasters in France may fairly be classed as bad upon evidence derived entirely from official French sources.

This evidence, which has been so widely published that it seems unnecessary to reproduce it here, indicates that in manufacture, storage and inspection, the methods used and the precautions taken have been such as almost to invite disaster.

The practice has obtained, for instance, of subjecting old and bad powders to a process of retreatment ("radoubage") and from that time forward regarding them as if they were new powders, issuing them to service with the date of retreatment as if this were the date of manufacture. It is, of course, possible to re-work old powders with so much completeness as will make them actually new. This is the case with the process of re-working which is used with United States powders, to which reference has already been made. Here the powder is ground up into finely divided particles of nitro-cellulose, which is then subjected to all the stages of washing, boiling, etc., through which it passed

in original manufacture, the diphenylamine being introduced at the same stage of manufacture, and every step of the original process being duplicated with absolute thoroughness. The French have a process of re-working ("ramalaxage") which, while much less thorough than our process just described, is much superior to their "radoubage," which was in use until 1907, which latter process consisted only in an attempt to restore the solvents which had evaporated from old powder, by soaking the grains in ether-alcohol solvent to which was added a small percentage of amyl-alcohol.

To subject a powder to such treatment as this and then regard it as new powder, dating from the date of this treatment, would seem to be bad enough, but with this practice was associated another which was even worse. This was to *blend* several lots of powder made at different times, with entirely different histories —some perhaps retreated and others not—and to issue them to service with a single designation as if they were of a single homogeneous lot, of one date of manufacture and one consistent history. It is clear that not only did the bad powders of such a blend entirely neutralize the good ones, but that no test could possibly have any value because it could not be representative of the whole lot.

It is an extraordinary and very significant fact that the powder which destroyed the *Liberté* (if indeed the fault actually lay in the powder) is thought to have been identified as being practically the same as that which destroyed the *Jéna;* that is to say, it was made at the same factory (Pont de Buis) at very nearly, if not exactly, the same time (1906) and by the same methods—methods which a later manager of the factory has condemned as criminally careless.

1. The explosion of the *Jéna* was caused by powder made by the factory in Pont De Buis. The explosion of the *Liberté* was caused by powder from the same source, but whose manufacture dates from the beginning of the year 1906.

2. At the end of the year 1906, the director of the factory of Pont de Buis was sent to that of Moulin Blanc and replaced by M. Maissin. The latter furnished, in 1907, a report in which he formally accused his predecessor of carelessness. In a manner very precise, he indicated that powder of bad quality had been retreated (that is to say indifferently restored by different chemical processes) at Pont de Buis, and delivered next, like new powder; *while giving for the date of its manufacture the date of the retreating.*

"These are are powders," said M. Maissin, "which have caused the catastrophe on the *Jéna*." "These are also those which caused that of the *Liberté*." The result of the actual investigation permits us to affirm in a manner almost positive that the exposion was due to the inflammation of a cartridge in the upper magazine of the starboard forward side. This magazine contained only the lot of powder B. M. 13 A. M. 8-2, 06. P. B. (Second lot 1906, Pont de Buis.)

All the artillery officers know that the dates of the lots of powder which are issued to them are absolutely illusory.—"*Le Matin*," October 25, 1911.

A lot is taken which has been proved in a gun. If, for example, the velocity obtained is greater by 15 or 20 meters than that which is desired, another lot is taken which gives a velocity too low. The two lots are mixed and so, by trying many mixtures of powder of different dates and origin, a mixture is obtained having the desired velocity.

At the time of the inquiry of the *Jéna*, there were many discussions on the very grave inconveniences which these mixtures presented, and notably Colonel Jacob was very explicit in this regard. He considers that the greatest improvement in manufacture will be to have unmixed lots.

The reason is simple. If you wish, in the sequel, one year after, two years after, to render account of the state of your powder, how would you do so with the tests admitted hitherto? You take off a sample and you see if it decomposes too rapidly at 110°. But, if you have in the lot which you examine several powders of very different origin, all that you will know is that the particular grain from which you have taken the the sample, is good; but can you say that another grain of the mixture, made at another time, will be good also?

It is certain that this sampling made at random will be good only if we have to do with a homogeneous lot.—*Statement by M. Paul Painleve, Chamber of Deputies Inquiry. Nov. 11, 1911. Page 2982.*

. . . . Among the memoranda of lots of powder issued to the Navy which have passed through my hands, is one which deals with a mixture so extraordinary that I think it my duty to communicate it without delay to the Budget Commission.

The lot of 15,124 kilos., dated 1909, included 8474 kilos., of powder finished in 1908, 4501 finished in 1906, 763 kilos., of remnants marked 1906, and 1386 of a mixture bearing the same date. This mixture is composed of powders which go back to 1904 and perhaps earlier. It is important to observe that this lot does not come from Pont de Buis, but from Sevran-Livray.

. . . . At Point du Buis, even very recently, the most extravagant mixtures were common. It is curious to note, under the administration of M. Maissin, more serious faults than those which he charges so bitterly against his predecessor. For example, a lot of powder dated 1908 contained a large proportion of powder retreated (radoubé) in 1901, and

therefore actually manufactured perhaps 5 tor 6 years earlier—so that the lot marked 1908 contained in reality powders of 1895 and 1896.—*Statement of M. Paul Painleve, Reporter of the Budget, in the Chamber of Deputies.*

The following note illustrates still another phase of this matter.

"It is well known that naval officers are charged only with the utilization of the artillery on board ship. The powders are delivered to them under the direction of the artillery-of-the-port, by the engineers of the artillery, a body entirely distinct from that of the naval officers.

Reliable information permits us to affirm that the orders of the artillery have not always executed promptly the ministerial regulations ordered after the catastrophe on the *Jéna*.

They had still in the squadron last Tuesday, Sept. 30, 1911, ammunition 13 or 14 years old. They delivered to the ships of the Third Squadron at Brest, before its departure for Toulon, the retreated lots, expressly prescribed since the *Jéna*. The commanders protested. The reply to them was, "There is no other powder." They had to take those powders on board.

The regulations for the conservation of powder says: "Ammunition should be inspected if it has undergone 35° for 14 days or 30° for 90 days."

Before the manœuvers the Charles Martel demanded the inspection of the magazine which had been subjected to this condition. It was refused. On board they had doubts about the lot; there were brown spots on the grains in the observation flask, which indicated a decomposition of the lot. The matter was referred to the artillery. A chief engineer came on board. He examined the grains and said, "There are evidently gunners who have placed their dirty hands on it."—"*Le Matin*," October, 1, 1911.

The latest news from France is to the effect that an entirely new system of supervision has been established by which the officers of the Army and Navy who are to use the powders, are given not only the privilege but the duty of supervising every stage of the manufacture of the powders and every feature of their subsequent life and treatment.

The new rules, established by a decree of the President of France, are quoted in the appendix in Note VIII. They correspond almost absolutely with the rules which have been in force in the Army and Navy of the United States from the earliest days of the manufacture of smokeless powder in this country.

Regarding the conditions to which the powders are exposed on board ship, we have already quoted the views of *Engineering*, as set forth in its editorial of October 30, 1908, following an analysis

of the conditions brought out by the *Jéna* investigation. For convenience of reference, the following paragraph is again quoted:

> . . . . it is quite clear that the disaster on board the *Jéna* was due to faulty location of the ammunition magazines and to imprudence generally. From this speech it is evident that the smokeless powders of any nation—and they are all practically the same composition—would have behaved in the same way in similar circumstances.—*Engineering*, October 30, 1908, Page 579. Editorial, "Smokeless Powders."

Without going as far as *Engineering* goes in this paragraph, we are unable to resist the conclusion that, to the danger inherent in powders badly made and imperfectly inspected, there was added, quite unnecessarily, in the *Jéna*, the *Liberté* and other French battleships, the danger arising from heat and moisture beyond what should have been tolerated and, we hope and believe, very far beyond what would be tolerated on a battleship of the United States Navy.

The criticism which has been so freely indulged in above of French methods of manufacture and treatment of their powders finds its justification in the fact, that, as already stated, every statement here given is taken from official information frankly given to the world by the French Government in an earnest endeavor to go to the heart of the causes which have resulted in the recent deplorable accidents to its Navy.

The statements made by *Engineering* with regard to the governments which use nitro-cellulose, and those which use nitro-glycerine, powders, are far from covering this ground completely, and as they stand may well convey an entirely false impression. There is no doubt that nitro-glycerine powders have certain rather marked advantages in convenience. And it happens that these advantages are such as to be especially important on ship-board. Other things being equal, the energy desired is obtained with materially smaller weight and bulk of cordite than of nitro-cellulose powder. This means not only that more rounds can be carried in the magazine but that the charges can be handled more easily and in smaller space, from which condition there follows a possible saving in the size and therefore in the weight of the turret. The smaller charge calls for a smaller powder chamber and this permits a shorter gun. All of these advantages are freely conceded. They have to do with *convenience*, not with *safety*; but in the judgment of certain governments they have sufficed to outweigh—in their application to ships—the advantages

of a widely different character which are very generally attributed to nitro-cellulose powders and which have been set forth in the preceding pages of this paper. It is peculiarly significant that, as pointed out by *Engineering*, Germany and several other powers, while using nitro-glycerine powders for the Navy, where the above advantages are important, use nitro-cellulose powders on shore, where matters of convenience are of little or no importance and where, accordingly, there is nothing to prevent the selection of the powder which is considered most advantageous from the view points of stability, erosion, etc. Granting that Germany feels bound to use nitro-glycerine powder for the Navy, there must be some very strong reason for accepting the inconveniences of using an entirely different powder for the Army. And so with all other powers which adopt this policy.

Again, it is hardly fair to count Japan, Argentina and Brazil as committed to the use of nitro-glycerine powders for naval purposes as a matter of deliberate policy. It has already been explained that guns designed for cordite have smaller chambers than those designed for nitro-cellulose powder. It follows from this, that a nation whose naval guns are of English manufacture and therefore designed for firing cordite is practically forced to use cordite for the Navy. If such a nation uses nitro-cellulose powder for the Army, this fact would seem to indicate a preference for the latter type of powder.

It has been reported from time to time that Japan was dissatisfied with cordite as a result of the destruction of the *Mikasa* and of the rapid erosion of the guns of all battleships during the war with Russia.

So far as England is concerned, we need not seek far for the explanation of her adherence to cordite. She has an enormous number of guns—on ship board, in fortification and in reserve—all of which have the small chambers which are characteristic of guns designed for cordite; and the magazines, turrets and ammunition-hoists of her ships are designed for handling the comparatively small and light charges of cordite which belong to this design. It is easy to imagine the difficulty and the expense which would be connected with a change to nitro-cellulose powder. And it is not difficult to imagine the panic which would follow the announcement that such a change was necessary. It is probable that all was done which could be done with prudence when the change was made from cordite mark I with its 58% of

nitro-glycerine, to cordite M. D. with 30%. This was a long step toward a nitro-cellulose powder and it is reported to have been a marked improvement.*

Looking at the matter from a view point broad enough to include both the armies and navies of military powers, and accepting the authority of *Engineering* as to the powders used, the list is as follows:

Nitro-glycerine Powder.	*Nitro-cellulose Powder.*
British Army	French Army
British Navy	French Navy
Italian Army	Russian Army
Italian Navy	Russian Navy
German Navy	United States Army
Japanese Navy (has heretofore used English guns)	United States Navy
	German Army
Argentina Navy (?) (has heretofore used English guns)	Japanese Army
	Argentina Army
Brazilian Navy (has heretofore used English guns)	Brazilian Army

(Signed) AUSTIN M. KNIGHT,
Rear Admiral United States Navy,
President of Board.

(Signed) ODUS C. HORNEY,
Lieutenant-Colonel United States Army,
Member.

(Signed) J. H. HOLDEN,
Lieutenant-Commander United States Navy,
Member.

(Signed) EDWARD P. O'HERN,
Major Ordnance Department United States Army,
Member.

(Signed) WILLIAM A. PHILLIPS,
Major Ordnance Department United States Army,
Member.

(Signed) W. L. PRYOR,
Lieutenant United States Navy,
Member.

* NOTE BY EDITOR NAVAL INSTITUTE PROCEEDINGS. Since the above was written, information has been received of a further reduction in the nitro-glycerine of cordite, which is now fixed at 23.5%. It is unnecessary to point out that this is a still closer approach to a pure nitro-cellulose powder.

APPENDIX

NOTES.

I. Modern Artillery—Lieut. A. T. Dawson, Late R. N. in *Engineering* March 8, 1901, Page 297.

II. Smokeless Powder—Editorial, *Engineering*, March 15, 1901.

III. Naval Ordnance—Lieut. A. T. Dawson, Late R. N. in *Engineering*, August 16, 1901, Page 234.

IV. Decomposition of Nitro-glycerine—Robert Robertson of the Royal Arsenal, Woolwich. Abstract of article in *Transactions of International Congress of Applied Chemistry*, 1909.

V. The Hydrolysis of Nitro-cellulose and Nitro-glycerine by Oswald Silberrad, Ph. D., and Robert Farmer, D. Sc., Ph. D., of the Royal Arsenal, Woolwich. Abstract of article in the *London Chemical Society Journal-Transactions*, 1892-1906, Page 1761.

VI. Treatise on the Instability of Nitro-cellulose—M. Jacques. Abstract of article in the Transactions International Chemical Congress-1906.

VII. Note on the Stability of Poudre B.—L. L'Heure. Abstract of article in *Memorial des Poudres et Salpetres*, XV. 1-38.

VIII. Inspection Powder and Explosives for the Use of French War and Navy Departments.

NOTE I.

Modern Artillery. Lieut. A. T. Dawson, Late Royal Navy. *Engineering*, March 8, 1901, page 297.

". . . . As to the type of powder to be used as a propellant, there is now practically no difference of opinion throughout Europe and America, the nitro-cellulose being preferred on all hands. The United States, Russia and France have adopted the nitro-cellulose form for sometime. Germany has been late in its adoptance, having used a form of nitro-glycerine powder containing about 25% nitro-glycerine but has now practically, I believe, decided to adopt a nitro-cellulose powder. Other small countries in Europe have not definitely decided on a particular type of explosive and may be generally said to be carrying out experiments. The fact, however, of nearly all the great countries of

the world, excepting our own, having adopted it, is to some extent a reason why our government should give it the greatest consideration. At the present time Great Britain is using cordite containing about 57% of nitro-glycerine. This powder has now been in use for about nine years, and in its day may be said to have been one of the best known explosives at the time of its introduction; it was absolutely necessary for our naval supremacy to introduce a smokeless powder; hence, I would represent that at that time Great Britain acted advisedly. The experience of the French until quite recently cannot be said to have been too highly satisfactory, as all will recall the serious explosion at Toulon not many years ago, which we have every reason to know was due to a deterioration of the powder in storage. Furthermore, I understand that the Russian Government's experience until 3 or 4 years ago was not all that could be desired, the nitro-cellulose from which it was made not being of the finest quality. In the United States they have now generally adopted nitro-cellulose powder in their fleet, and are introducing it into their land service. I understand the experience with this powder in the U. S. Navy is everything that could be desired, although I believe they are constantly carrying out experiments with a view of improvement. The United States land service, however, have until quite recently used a nitro-glycerine powder containing about 10% of nitro-glycerine. The experience they have had with their powder has been anything but satisfactory, and on many occasions they have had serious high pressures in their guns, in some cases completely destroying the artillery using it. The experiences of foreign powers tend to show the wise policy of the British Government in not adopting a nitro-cellulose powder at the time of its original initiation. Since that period, however, the manufacture of nitro-cellulose powders has very greatly improved, and the powders now being adopted by Russia and Germany are quite as safe in their use as cordite and other known modifications of cordite having various percentages of nitro-glycerine.

"Nitro-cellulose powder has the great advantage of being capable of producing in modern artillery the highest possible ballistics with the least possible amount of wear to the gun; and therefore at the moment its introduction should be treated from a most serious standpoint. . . . . In guns of low power using

cordite the effect of erosion is, of course, much less than in guns using large charges; but I contend that as it is necessary for modern artillery, except that for special purposes, to have the highest possible ballistics, it is of primary importance to use a powder which, as far as possible, gets over the objections I have just mentioned.

"The usual objection put forth to the introduction of the nitro-cellulose powder is that it will not keep on foreign stations with variable climates. This I must state is erroneous—I have results of nitro-cellulose powders stored in some of the hottest climates, and these have proved in every way satisfactory, both chemically and ballistically, when fired in guns. Some of the great German chemists have had this powder under various heat tests for many years and have reported to me their definite opinion that nitro-cellulose powders, if properly made, are to be relied upon not to deteriorate any more than cordite and other nitro-glycerine powders when subjected to variable climatic influences.

"I have heard it sometimes said abroad that better ballistics can be obtained in a rifle using nitro-glycerine powders as against cartridges made up of nitro-cellulose powders. This belief is unfounded, as I have been able to obtain from rifle cartridges of the smallest size used in Europe, higher ballistics with nitro-cellulose powder than with cordite at normal temperatures, say, between 60° and 70° F.

"Having laid particular stress on the importance of nitro-cellulose powders because they are the only ones by which we can obtain constant high velocities up to say 5000 f. s., I will now call your attention to my dangerous space diagram, showing the difference between the effect of firing with a high velocity . . . ."

NOTE II.

Smokeless Powder. *Engineering*, March 15, 1901. "Editorial."

". . . . Cordite is the powder in use in all our guns, and it has had its trial in the South African war. What are the results? It is no secret that the erosion with cordite is most excessive, and we believe that this is so even with guns not designed to give the highest energies now necessary in modern artillery. We understand that many of our field pieces in the Transvaal have been returned "badly eroded," and, further, that many of the 4.7-inch guns in the Transvaal, supplied by the Navy from

Simon's Town, had to be replaced, owing to the wear in the bore quite spoiling the shooting. As an instance of the irregularity, we may mention that the firing of the 4.7-inch gun varied in range by over 400 yards. This fact alone demonstrates to the country the serious peril involved in continuing the use of cordite. It is obvious that if these disadvantages are now appearing in the present conflict, in which but a comparatively small number of guns are being utilized, a very lamentable position would be created if we were at war, say, with two first-class maritime powers, in which the long range and the efficiency of the guns must practically control the final result. It surely is a very short-sighted policy not to take active measures when such facts are well known.

"Lieutenant Dawson strongly advocates the use of some form of nitro-cellulose—a compound now adopted by most of the first-class powers, and in his lecture he demonstrated its many advantages; but in a leading article of the "*Times*" of the 7th inst., on Lieut. Dawson's address, it was stated that 50% more nitro-cellulose powder was necessary than of cordite to obtain the same velocity, and, furthermore, that the cost of this powder was three times, and possibly four times that of cordite. These two statements have been met by Lieutenant Dawson in a letter to our contemporary on the 9th inst. He proves the statements to be misleading by giving the results of experiments with a 6-inch (45 cal.) gun, in which a charge of 28.6 lbs of cordite gave a velocity of 2875 f. s., whereas 36 lbs. of Rottweil powder (the German nitro-cellulose compound) gave 2910 f. s. in the same gun. The energy corresponding to a velocity of 2910 f. s. is 5872 foot tons, while the energy of the same gun at present in the service using cordite giving a velocity of 2530 f. s. is only 4438 foot tons, showing that if nitro-cellulose powder is used an increase of energy of 1434 foot tons, equal to 32%, is possible. Such an increase of energy by the use of nitro-cellulose powder fully warrants our seriously drawing attention to the necessity for the immediate introduction of a new type of powder.

"As to the relative weights of charges with nitro-cellulose powder and cordite, we understand that should it be decided to keep to practically the same energies with existing guns, but making use of a nitro-cellulose powder, which will more than double their lives and preserve the shooting of the guns efficient

during such life, the charges would not have to be increased in weight by much more than from 5 to 10%.

"Now at the present moment the country is committed to the purchase of many hundreds of the latest type of 6-inch quick firing guns, and a very large number of the heaviest pieces of artillery are now being prepared for installation in our principal fortresses. The question of the powder which is to be used for these guns must now be settled. It is true that for many months there has been sitting, under the Presidency of Lord Rayleigh, a committee, in whose hands we believe the question of the introduction of explosives now rests. We hope for the good of the country that the committee will soon see their way to make a specific recommendation, having in view this large amount of modern artillery which is being obtained for both our fleet and land service, and the consequently serious consideration of what modern explosive should be made use of in connection with this artillery. We do not think it can be too forcibly represented that the committee should, with the knowledge which they must now have accumulated, be in a position to make some recommendations, so that the new artillery now entering the services may have the advantage of using, at all events, what they believe at the present time to be the most suitable explosive. If the purpose of the committee is to develop a new cannon powder, we fear that the position of this country must in the meantime seriously suffer, for it should be patent to all that to go on amassing many thousands of tons of an explosive well known to be inferior to what other countries are using, may be a serious detriment to our interests, and tend politically to embarrass us. The large production of nitro-cellulose powder going on in Russia, France, and Germany should surely be an example to ourselves, who have for many years used an inferior makeshift, and should receive the attention of those now highest in power and responsible for the defenses of this country. . . ."

NOTE III.

Naval Ordnance. Lieutenant A. T. Dawson, Late Royal Navy. *Engineering*, August 16, 1901, page 234.

"The most important considerations in determining the best composition of powder to be adopted are, firstly, its keeping qualities and safety under normal climatic conditions; secondly,

its capability of obtaining the highest possible ballistics, and consequently the flattest trajectory; and thirdly, its regularity in results, so that the ballistics may not be seriously affected by change of temperature or by the wearing away of the gun due to excessive erosion. All these qualities are secured by the use of a properly manufactured nitro-cellulose powder, whereas none of these conditions can be said to be met by any powder containing nitro-glycerine.

"At the present time the Russian Goverment manufactures the largest quantity of nitro-cellulose powder. Up to about two years ago all the conditions enumerated were not fulfilled, owing to the nitro-cellulose used for the powder not being quite satisfactory; but since then they have obtained the best results by using the system employed by the Cologne Rotweil Company at their factory at Schluselburg. In France and Russia also great difficulty was experienced at the outset in obtaining a really suitable nitro-cellulose, and in carrying out the necessary operations to render the powder really homogeneous and safe. Indeed, it is only by careful study and much experiment that the manufacture of nitro-cellulose powder has now become really reliable and stable. The most serious experimental work in connection with this matter has been carried out by the Cologne Rotweil Company, at whose establishment extensive chemical research is always in progress. The Russian Government realized this some years ago, and in consequence gave this company a large number of orders, rendering it possible for them to establish large works in Russia for the development and manufacture of this highly important artillery necessity. Thus the average production in Russia of nitro-cellulose powder, manufactured upon a Rotweil system, amounts now to about 400 tons per annum.

"It may not have been quite appropriate to introduce the subject of powder into a paper on the mechanical engineering details of ordnance, but the reference made is probably justified by the important results following from the use of propelling powder of the nitro-cellulose composition. Indeed, it is, in the author's opinion, the only suitable compound for use with high-power artillery, and as experiments have convinced the author that powders containing even a small proportion of nitro-glycerine are unsuited to guns developing high velocity, he believes that the British authorities would be well advised in adopting the nitro-

cellulose compound. Difficulties, no doubt, would attend such change at the outset; but the wear of the guns at present, with all attendant disadvantages, makes the alteration almost imperative, especially when great power and rapidity of fire are sought for, as erosion increases at a much higher percentage with nitro-glycerine, and necessitates an exceptionally large reserve of guns being kept.

NOTE IV.

Decomposition of Nitro-glycerine. International Congress of Applied Chemistry, 1909. Robert Robertson, of the Royal Arsenal, Woolwich. (Abstract.)

"Will (Untersuchungen über die Stabiltät von nitrozellulose, 1 and 2, Mitt. Zentrablatt.) in his experiments arrived at the conclusion that a normal or intrinsic decomposition is characteristic of cellulose nitric esters, including gun cotton. The rate of decomposition of pure nitro-cellulose is a function of the temperature *and degree of nitration.* Instability may be detected by irregularity in decomposition or by an abnormal coefficient of N evolution." Robertson says: "Decomposition of nitro-glycerine with the removal of volatile products was studied between temperatures of 90° and 135° C. and obtained the following results":

"(1) In the apparatus used, the decomposition of nitro-glycerine proceeds in a manner as uniform as that of a stable gun cotton, when volatile products of decomposition are continuously removed.

"(2) The rate of decomposition is a function of the temperature, doubling for every five degree change between 95° and 135° C.

"(3) Nitro-glycerine has a higher rate of decomposition than gun cotton under similar conditions."

NOTE V.

The Hydrolysis of Nitro-cellulose and Nitro-glycerine. Oswald Silberrad, Ph. D., and Robt. Farmer, D. Sc., Ph. D., of the Royal Arsenal, Woolwich. From *London Chemical Society Journay-Transactions,* 1892-1906, page 1761. (Abstract.)

"Hydrolysis of Gelatinized Nitro-cellulose, etc.—Gelatinized nitro-cellulose differs so strongly from gun cotton in the compactness of its structure, that it appeared of importance to ascertain whether it underwent a similar hydrolysis in presence of

alkali. The course of the reaction was found to be quite analogous in the two forms of nitro-cellulose."

"In view of the wide application of gelatinized preparations, containing both nitro-cellulose and nitro-glycerine, an examination of their hydrolysis was of practical importance. Their behavior is somewhat interesting. It is known that nitro-glycerine volatilizes fairly readily from explosives containing it, and since experiment shows that this ester saponifies rapidly in alkaline solution, it is to be expected that the nitro-glycerine from such explosives will also undergo a similar hydrolysis. This is confirmed by experiments on cordite and ballistite. Both of these show a rapid hydrolysis in alkaline solution. An analysis of the residual cordite after hydrolysis shows that the hydrolysis is due almost entirely to nitro-glycerine which has passed from the explosive into the aqueous solution. Thus it was found that 70% of the nitro-glycerine in a cordite had undergone saponification, while the nitro-cellulose was almost unaltered."

"This throws considerable light on the mechanism of the changes which occur when cordites are subjected to prolonged storage, and the relative stability of cordite as compared with nitro-cellulose powder when stored in a damp atmosphere."

NOTE VI.

Treatise on Instability of Nitro-cellulose. M. Jacques, International Chemical Congress 1906 at Rome, (Abstract).

"The stability of nitro-cellulose depends on the main elements of climate, temperature, humidity, and method of stowing. It is influenced by (1) constitution of the nitro-cellulose (2) presence and quantities of impurities (3) treatment of the powder, care, etc.

"Even under the most favorable conditions there is a gradual retrogradation of stability,' which cannot be avoided.

"Causes of instability: 1. Nature of the nitro-cellulose. The instability of nitro-cellulose, or gun cotton, is most marked *at the limits of nitration.* What is sought in the French Powders is a mixture of stable form, stable *per se,* and stable in the mixture. Through the desirability of introducing high nitrated insoluble nitro-cellulose, this mixture is hard to obtain.

"Stability varies directly as contained moisture, and inversely as contained sulphuric acids, nitrogen, and as the temperature.

"In blending the powder the subsequent stability will be determined by (1) the state of the cellulose as to moisture (2) as to purity (3) means of mixing (4) density of mixture (5) temperature of operation (6) length of mixing process.

"Cause 2: Impurities—it is practicably impossible to drive out all impurities; there remain a few traces of nitrates, aldehydes, and organic acids, such as oxalic acid.

"Litmus tests usually show acid reaction due to minor impurities, rather than actual decomposition of the whole.

"Tests taken at any time are not good for any future time, as unsafe conditions may start serious reaction due to impurities.

"The best way to get rid of the impurities is by making the washing process in the manufacture most thorough, and doing it in an alcohol.

"Means of determining instability; tests:

"Heat and Litmus tests recommended. Heat tests show the condition of the powder as a whole; the Litmus test will show either that or presence of acid impurities. Heat test recommended is M. Sy's test of noting loss of weight of sample heated to 115° for 8 hours a day, or for quicker results, to 130-140°.

"The Litmus (including all paper tests, with iodide of zinc, diphenylamine, and chlorhydrate of metaphenlendiamine) tests may show either actual total decomposition, or slight decomposition due to traces of impurities.

"The author claims, therefore, that both tests should be made, the heat test to determine any latent instability in the whole mass, shown by excessive loss of weight due to volatile matters, the paper to show either that, or, in case the heat test is O. K. and paper test bad, the presence of impurities.

NOTE VII.

Note on the Stability of Poudre B. L. L'heure. Memorial des Poudre et Salpetres, XV, 1-38. Translation by C. G. Storm. (Abstract.)

"This note is a study of the behavior of Poudre B in sealed tubes, in various atmospheres, (air, nitrogen, carbonic acid) in some cases leaving the nitrous decomposition products in the atmosphere of the powder; in other cases absorbing them by means of a wad of silk or by diphenylurea (the researches of Vielle have shown that these substances easily fix the nitrous

compound). Temperatures of 110° and 75° have been used, as from results at these temperatures one can predict with considerable accuracy as to the stability at lower temperatures.

"Results of first and second series. These tests showed the superiority of sealed tubes over open ones from the consideration of stability, after heating at 110°, in cases where the tubes contained CO_2 or air with silk wool. It is seen that in the sealed tubes the stability at 110° decreases very slowly. The powder undergoes a slow decomposition, as indicated by the decrease in amount of N.

"Third Series.—The decomposition of the powder is only slightly reduced by absorption of the nitrous products, where open tubes are used.

"Fourth Series.—Results indicate advantage of heating in sealed tubes in air even without absorbents for NO, etc.

"Fifth Series.—These tests indicate the value of absorption of the nitrous products. (Closed tubes.)

"Sixth Series.—Several powders tested indicate that results obtained with several varieties of Poudre B agree with those obtained for Poudre B. F.

"Seventh Series.—Results show the advantage of sealed tubes and of absorption. (Tests at 75 with atmosphere of N and also of air with silk plug.)

"Eighth Series.—Results indicate that a sample of Poudre B. N. F. of poor stability is improved by heating in sealed tubes.

"Ninth Series.—1. Stability is not improved by replacing open tubes by one partly closed and containing an absorbent for NO_2.

"2. The superiority of sealed to open tubes is indicated, but results show that air, CO_2 and N give very little difference in stability.

"3. Powder heated in sealed tubes retains not only its chemical stability, but its ballistic properties as well.

"4. A gradual slow decomposition of the powder is indicated by loss of N and coloring of the silk.

"5. The pressure in the tube is always relatively low.

"Tenth Series.—Results similar to ninth series.

"Eleventh Series.—Tests made on large grain powders and confirmed the previous tests on fine powder, showing the superiority of sealed tubes compared to open tubes."

GENERAL RÉSUMÉ.

"The stability of powder at 110° and 75° is considerably increased by enclosing in sealed tubes, containing an inert atmosphere (air, N, or CO_2) and an absorbent for nitrous products (silk, for example).

"The tests show that prolonged heating at 75° (for as much as 80 days) does not appreciably affect its resistance to the ordinary 110° test. However, decomposition is not entirely arrested; the loss of N, loss of weight, reduction in velocity and, finally, the gradual darkening of color of the silk wool, show decomposition to be continuous, but very slow.

"At 110° the pressure in the tubes increases rapidly to the bursting point, amounting to several atmospheres; at 75° the pressure never exceeds 1 Kg., even after 80 days of heating.

"The absorption of nitrous products in the atmosphere of the open tubes or those partly closed, gives no appreciable benefits."

HYPOTHESIS.

"The fact that powder at high temperatures is better preserved in sealed than in open tubes, may be attributed partly to th fact of the pressure developed in the interior of the tubes during heating and partly to the fact that the solvent remains in the powder instead of being volatilized. We have attempted to determine the respective influence of each of these factors.

"1. Influence of pressure.—The results of several tests indicate that the effect of slight pressures is very small, when the solvent is eliminated; so that the the beneficial effect of heating in sealed tubes cannot be attributed to the pressure.

"2. Influence of solvent.—The process used consisted in heating the powder in open tubes in an atmosphere kept partly saturated by vapors of alcohol and ether, thus preventing loss of the solvent in the powder.

"The results showed clearly that the retention of the solvent in the tube is the chief cause of the benefit gained by heating the powder in sealed tubes.

"The presence of the solvent vapor in the atmosphere of the powder does not prevent nitrous decomposition, but, on the other hand, the gradual yellowing of the silk indicated progressive decomposition, as did also the constant decrease in N contents, and loss of weight of the powder.

"As the solvent does not retard dissociation of the nitro-cellulose, it is necessary to find the cause of its marked effect on stability.

"The following explanation is proposed.

"(a) Nitro-cellulose.

"The decomposition of nitro-cellulose (powdered) by heat is a simple phenomenon of dissociation, and the speed of evolution of nitrous products is constant at a given pressure and temperature, when the products diffuse freely into the air.

"For the nitro-cellulose agglomerated by compression, the phenomenon of dissociation is complicated by secondary reactions in the interior of the mass, the nitrous products of decomposition react on the nitro-cellulose molecules and increase the rate of decomposition. Thus, under mechanical compression, there remain inter-molecular spaces, sufficient for passage of the gas. These secondary reactions explain the low stability of nitro-cellulose made compact by pressure without gelatination. (Experiments of Vielle).

"(b) Colloids and Poudre B.

"In perfect colloids the agglomeration of the molecules is sufficient to reduce the inter-molecular spaces to a dimension less than that of the gas molecules, as a very thin membrane of collodion prevents diffusion of gas. Gaseous products cannot then form in the space between the molecules, and hence the effect is to limit molecular dissociation on heating to the surface which is in free contact with the atmosphere.

"But under the action of heat, the solvent molecules are eliminated, little by little, and spaces tend to form. After a certain time the colloid undergoes shrinkage, which may be sufficient to fill up these gaps. However, a point is reached where the shrinkage ceases and where the loss of solvent creates interior channels sufficient for passage of gas. The molecules of nitro-cellulose in contact with the channels may then be dissociated, and the nitrous dissociation products produce secondary reaction dangerous to the stability of the nitro-cellulose.

"On this hypothesis the stability of Poudre B is intimately connected with its degree of compactness, and the harmful effect of heating consists more in the destruction of its compactness by elimination of the solvent than in a direct decomposition of the nitro-cellulose.

"The ordinary 110° test gives a measure of the time necessary to produce a dangerous porosity in the powder.

"Heating in a sealed tube, preventing entirely the loss of solvent, alters very little the original stability of the powder.

"The principal action of stabilizing bodies (amyl-alcohol, Urea, diphenylamine, etc.) is to absorb nitrous products and reduce their formation in the interior of the powder, thus retarding the dangerous effects of porosity.

"Thus, the introduction into Poudre B of substances having an affinity for nitrous vapors considerably increases its stability, while the absorption of these nitrous products from the atmosphere of the powder has no beneficial effects, as noted in tests of series, 3, 9, and 10.

"The benefits gained at 75° having been as great as at 110°, it is almost certain that storage in completely sealed receptacles at ordinary temperature will increase stability at higher temperature.

"It does not appear impossible to realize a practical method of preservation comparable to that in sealed tubes, and we hope for the adoption of absolutely air-tight metallic cases for Poudre B and particularly for powders stored in hot magazines.

"The presence in the powder of a wad of silk wool for the absorption of nitrous products in the atmosphere of the metal case would also be of benefit."

NOTE VIII.

Inspection of Powder and Explosives for use of French War and Navy Departments.

As a result of the accident on board the *Liberté*, of the insistent demand of the Navy Department to inspect the manufacture of all powder intended for naval purposes, and of the recent investigation by the Chambre of Deputies of what has been termed in France the "Scandale des Poudres," the Ministers of War and Marine made a report to the President which has resulted in the following decree;

"The President of the French Republic,

"Acting upon the reports of the Ministers of War and of Marine,

"Considering that it is important that the department employing powder and explosives should be in a position to inspect the manner in which their orders for the same are executed,

"Decrees:

"Article 1.—That, for the purpose of enabling the War and Navy Departments to follow the manner in which their orders for powder and explosives are executed, inspection departments shall be established in all powder works.

"Article 2.—This inspection will be made under the direction of the Ministers of War and of Marine, each acting independently of the other.

"The personnel assigned to this duty will comprise:

"*For the War Department:*

Artillery officers of the Army.

Administrative officers of the Ordnance Department.

Subaltern officers.

"*For the Navy Department:*

Naval officers.

Naval ordnance engineers.

Administrative officers, non-commissioned officers and technical employees of the Navy and Naval Ordnance Department, and civilian employees of the Navy.

"The bureau of inspection for the War Department will be attached to the powder board of the War Department at Versailles and placed under the orders of the general, president of that board.

"The bureau of inspection for the Navy Department will be attached to the inspection department of manufactures of naval ordnance and placed under the orders of the inspector of manufactures.

"The bureau of inspection of each of these two ministerial departments will have a laboratory in which will be made the tests prescribed by the specifications, the tests defined by the regulations concerning the manufacture and the conditions of acceptance, and in general all experiments and tests concerning powder and explosives.

"The laboratory of the bureau of inspection of the Navy will be attached to the central laboratory of the Navy.

"Article 3.—Inspection will be made for the acceptance of raw materials, of the process of manufacture, and of the processes comprising either the constitution of the elements of the lots or of the lots themselves.

"Article 4.—The inspectors shall have access to all parts of the powder works, laboratories, and proving grounds, as well as to all storerooms containing raw materials, powder or explosives finished or in process of manufacture.

"The personnel directing the manufacturing establishments as well as the shop foreman will give the inspectors all information required concerning the details of manufacture.

"The inspectors will refrain from any interference in the processes of manufacture.

"Article 5.—The officers and employees of the Navy Department assigned to the inspection department of the manufacture of powder and explosives will be authorized, upon the request of the Minister of Marine, to pass periods of instruction in the 'Laboratoire Central des Poudres et Salpetres,' at the powder board at Versailles and in the establishments of the War Department charged with the execution of orders for powder and explosives for the Navy.

"Article 6.—Special orders from one or both departments, according to circumstances, will arrange details for the application of the present decree in the powder works coming under the authority of the War and Navy Departments, and, if necessary, in private works.

"Article 7.—The Ministers of War and of the Navy are respectively charged with the execution of the present decree, which will be inserted in the '*Bulletin des Lois.*'

"Paris, November 23, 1911."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE VANDALIA'S FLAG.

By WILLIAM CHURCHILL,

Sometime Consul-General of the United States for Tonga and Samoa.

I find that I have kept no record of the transactions in the matter of the *Vandalia's* flag other than skeleton memoranda that I wrote a despatch urging the State Department to condemn it off my property return in Apia, and take it to Washington where the ravages of time would gnaw less quickly, and that some months later I had received instructions as requested and shipped the historic ensign. Details, it will be seen, are lacking, but they remain in my mind with sufficient accuracy.

Take up the story of the disaster where Louis Stevenson left it off in his "Footnote of History." I cite this because it is the most accessible account, the best story of those days and nights of gale was written by John P. Dunning, Associated Press correspondent, and published a month or six weeks after the event by the papers taking that service. It may be yet more convenient to take up the story at the end of my brief letter[1] when presenting to the Academy the autographed photographs of Seumanutafa and Fa'atulia, it would be a fit tribute that the flag and the pictures should find display together.

Sullenly the clouds drew back from the sea, the slope of Mount Vaea came into sight once more, a sight of ruin of a landscape once smiling. Upward and backward the heavy clouds slowly withdrew, men saw again after dreadful days the peak of Vaea, then slope after slope of the rearward mountain was revealed. At last the dull weight lifted from the Tuasivi at the summit of the

[1] UNITED STATES NAVAL INSTITUTE PROCEEDINGS, XXXIV, 601.

mountain crest, to windward the sharp ridges of Letongo Mountain were once more visible, to the leeward the eye found again the flat table top of Tofua.

The wind was stilled. That wind, the source of all the evil that had been wrought; *afflavit Deus et dissipati sunt*, the Armada motto, yet ours was an Armada trapped helpless in Apia, *Trenton, Vandalia, Nipsic*, wood they were and they were snarling with steel, yet they would have fought man for man had not wind set on a battle gage which neither foe nor friend could decline, a hopeless contest of man against an onshore gale and the biting reef within the tossing of a biscuit. The sea alone was in turmoil when the breeze went down and the nimbus of the storm went upward. You cannot imagine the sea within the Apia reef, it fights and worries for days after the gales have passed; the Vaisingano, pleasantly named the river of the fragrant pandanus blooms, pours torrents over its bar of coral chips; the currents swirl between the reef groves, gnawing, rending, tearing. Fine bones there were to pick in Apia harbor.

Close to the Vaisingano mouth and a little to the westward lay the *Olga* and the *Eber* stranded and torn; a little farther to the west and on a coral shelf, to which local taste has given the name Cape Horn, lay the *Adler*, tossed high out of water, her keel barely awash at high water full and change; there she lies to-day blushing with rust at such unwonted ship burial, riven is her hull, corkscrewed in the pleasant air. East of Vaisingano on the coral stretch which extends northward to form Matautu Point lay the *Trenton*, dead, lay the *Vandalia*, dead; two dead ships, but even dead they were not disgraced. Higher up the point lay the *Nipsic*, stranded, sorely wounded, but still alive. How she got in safety to that beach no man ever knew. She writhed like a cat in and out among corals which should have torn her bottom out, what she could not dodge she rammed and broke a miracle way through. Ten years afterward when on formal visits to receive the quota of nine guns speaking the peaceful salutation, the shortest way for my gig was through a lane gouged athwart two reefs, the path which the *Nipsic* had pioneered, scarcely in a century may the madrepores repair what this sole surviving ship did to their walls and bulwarks.

Kimberly, on the beach—no admiral was ever disgraced by striking his flag to the elements in their fury—intent upon the first

duty of all captains courageous, was caring for his men whom the sea had spared. There were survivors to be housed; what became of Seumanutafa's Samoans it is hard to say, for every roof that had escaped the gale protected more than its complement of the rescued. There were survivors to be fed, and the fury of the hurricane had spared the land no more than the sea; rations were a crying problem in a scarcely civilized community where to-day's feast means to-morrow's famine. There were the dead to bury. Every day saw the firing parties winding up the Ifiifi road to a little hillock where grave after grave lengthened the orderly line of burial quarters, there to lie still until the last draft came to carry the crews home to Mare Island.

If food was hard to come at in these first days on the beach drink was put still further out of reach. Here enters Blacklock. You will find Blacklock threading through this narrative, William Blacklock, Vice Consul-General of the United States, by long odds the finest figure that the motley show of Samoa has ever presented. I had cause to regret that I yielded to high representations and neglected to continue him in office; one of the pleasantest recollections of my tour of duty is that at the end I was able to renominate him to the post. It was Blacklock, when the gale was at its worst, who went through the wickedness of waterside Apia and closed the bars; just what his authority might have been no one really ever knew, but a moral force in time of need is superior to ordinances of aldermen and such like foolish officialdom.

Those processions to Ifiifi, and they were spread along many days as the sea reluctant yielded its prey, were not the only funerals. There were dead in the narrow harbor, dead ships to bury and no ritual in any prayer book for such solemnity. It is easy for the disciplined mind to contemplate the death of a ship in her own element, no one but can feel the thrill when the trooper *Birkenhead* makes her last plunge and the gale pauses abashed at the rattle of accouterments and the soft thud of pieces when aligned on decks already awash platoons present arms to their only conqueror. But what to do with ship corpses on the shore? The dead ships were a danger to the living, twice a day the tides washed out of their bowels that which was a menace to the community. Dead ships caught fast in the coral of a treacherous shore cannot bury their dead. Help must come from somewhere.

Again Blacklock. I have said that he was Vice Consul-General. More than that, he was acting in the place of his absent chief. There were regulations, the navy had its set of regulations, the State Department had its volume of regulations, Blacklock was doubly bound. But coils of the reddest tape could not hold such a man. What could not be done by him in the coils of regulation could be done by a corporation. There sprang into being the Trenton and Vandalia Wrecking Company, its first duty to preserve the little town from the pestilence breeding to windward. It was all Blacklock working for good, sometimes a little difficult to know whether it was Blacklock in official position, or the company, working hotly in the burial of the dead ships. But the work was done, the ships were torn to pieces and the menace was lifted from the town.

It is pleasant to recall the courtesies paid the *Calliope* as she inched her way through the bottle neck of the barrier reefs and at long last won out to the safety of the open sea. Ready to die the *Trenton* lay in that passage steaming to her anchors and dragging, her death the only thing that could give the *Calliope* the chance to be free. Yet as the *Calliope* went by full honors were given and returned, *ave, Caesar, morituri,* as gentlemen and gentle ships should do. When we see the executives keeping their manners in the article of death it does not surprise us that the fleet fought through its supreme engagement with colors flying, there is a dress of death and these ships wore it.

After the havoc had all been wrought there rose above the water the ensign of the *Vandalia,* sodden with the weight of rain in its four fathoms of breadth, far too heavy to be rippled by the milder breezes, hanging in mourning over the wreck and death below. It was Carlin's duty to strike the flag when all was over, once ensign now wreck stuff and mere salvage. In time of such disaster men know men, Carlin gave the flag to Blacklock, a fitting disposition. Modest above all things Blacklock would not accept it for himself, it was to him something too fine for any Trenton and Vandalia Wrecking Company then coming into being out of the nation's loss. He inscribed it on the property return of the consulate and gave it the noble space on the wall, in time he decorated its place of honor with rusted cutlasses and coral-clogged firearms, to which in my own time and in recognition of the same fetichism I added weighter decoration of shells from the *Trenton's* magazine.

There it hung for ten years. I knew it would leave an emptiness and a void when I shipped it home to custody where it would ever be a green memory. What else could I do? There was the mildew to fear in an unequal fight. There were ravaging insects at work upon the bunting. Once I had a reverend visitor, his title left me incautious, only just in the nick of time did I hold back his pocket knife from the star which he sought to excise from the field of thirty-eight. I am glad that this flag which the *Vandalia* wore to her death will find its proper home in loving keeping where new sailor generations are bred. It is a record of disaster, it is the flag of a surrender, but we are proud of its reminder that in all history only one foe has ever seen the flags of an American squadron come down, that foe the brute violence of the angry heavens.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WHAT'S THE MATTER WITH THE NAVAL ACADEMY?

A PLEA FOR A FIVE YEAR COURSE.

By LIEUT.-COMMANDER A. W. HINDS, U. S. Navy.

There is probably no school in the country with a better reputation for thoroughness than the U. S. Naval Academy; and there are many reasons why the Academy should have this fair reputation. The instructors are conscientious—both the civilians and the naval officers. The sections consisting of from 9 to 12 midshipmen are small enough, ordinarily, to allow for individual instruction in addition to the assignment of marks for gradation. Compared to other schools the sections here are only about one third as large.

The arrangements for the midshipmen are almost ideal. The quarters are comfortable; the food is good; the study and exercise hours are remarkably well balanced; during study hours there is no interference by room to room visiting; there is not the slightest ground for the criticism of the late Mr. Crane on all college courses, *i. e.*, that a large percentage of college undergraduates spend their time getting drunk.

It would be a difficult matter to suggest any method of teaching better than the one that has been used here, with success, for many years. Lessons are assigned and the midshipmen dig them out for themselves. Day after day they recite on these lessons—tell what they have learned about them and receive a mark for the day's work. This gives them confidence and teaches them to rely on their own efforts. At the end of a month an examination brings out what the midshipman have retained of the month's work and the semi-annual and annual examinations show whether they have kept in their minds the general principles covered during the term's work. The system of teaching used at the Naval

Academy is used by very few other schools in the country—in fact West Point is probably the only other school using it. The reason of this is that at the other instituions of learning the sections are too large and the instructors too few to allow much individual instruction or to allow for individual recitations. The number of instructors provided for the school is of course a function of the money provided for running expenses; the number here is, ordinarily, sufficient for the needs of the school. Where there are 25 or 30 students in a section the only feasible way to cover the subject matter is to have lectures, *i. e.*, have the instructor do the reciting, and find, from examinations, what the students have learned. There are two main objections to the to the lecture system. (1) There is a certain amount of inattention even at the most interesting lecture; at some time during the talk the thread will be lost, and, even though this may be momentarily, the value of the lecture will be decreased by reason of such loss. (2) It is a bad policy to work out the difficult problems for a student; he will remember much longer if he is compelled to work out everything for himself. **It is very probable that if the other schools of the country had enough instructors to keep the sections small they would use the same system of teaching used at the Naval Academy.**

CRITICISM CREEPING IN.

Notwithstanding the fact that the methods of teaching used here are good, and that the midshipmen probably use more of the four years at the Naval Academy to advantage, on an average, than is used in other schools, criticism of the Academy and its graduates are creeping in—from the fleet and from other sources. A straw vote taken here would show that the majority of the instructors and heads of departments think that in preparing them for their life work we are not giving the midshipmen the best course we could give them.

The main trouble with our course as it now stands is that it is **one year too short.** Twenty-five years ago the principal studies at the Naval Academy were mathematics, English, physics and chemistry, seamanship, navigation, and modern languages. Marine engineering and ordnance required only a fraction of the time they now require.

At that time the course was well covered, for there was great competition for the comparatively few commissions issued to each class. The time taken to graduate was the same as it is now—four years. During the twenty-five years some of the studies like mathematics, navigation, physics and chemistry, English, and modern languages have changed very little. Other studies like marine and electrical engineering and ordnance and gunnery have changed greatly. The changes in the last named have all been **additive.** It seems fair to say that all three have doubled in the amount the midshipmen have to learn in order to thoroughly understand the subject; and yet, with the entrance requirements very close to what they were then we are trying to cram all this **additional** learning into the heads of the midshipmen in the same length of time as was taken twenty-five years ago.

A comparison of the number of two hour periods spent on each subject in 1889-1900 and 1911-1912 is interesting.

Year	Mathematics	Mechanical drawing	English	Languages	Seamanship	Navigation	Physics and chemistry	Electrical Eng.	Marine engineering and naval construction	Ordnance and gunnery
1899-1900	496	208	208	224	64	176	140	110	304	96
1911-1912	442	112	192	224	128	176	96	192	320	160

This table shows that mathematics has lost 54 periods, physics and chemistry 44 periods, and mechanical drawing 96 periods during the past ten years.

The loss in mathematics is the one that does the heaviest damage; it hurts the courses in physics and chemistry, in navigation, in ordnance and gunnery, and in marine and electrical engineering—practically all other subjects. On account of lack of time and lack of practice in mathematics, the students, at the present time, take up new subjects poorly equipped. They cannot perform the ordinary operations of algebra and trigonometry rapidly and accurately, and instead of spending their time and energy on new work they have to spend it in reviewing mathematics in order to apply it intelligently to the allied subject.

The loss in physics and chemistry is also a drawback. From a study of the courses at West Point, and at other schools, it ap-

pears that they spend much more time on these subjects than is spent at the Naval Academy. A knowledge of both physics and chemistry is needed in a successful naval career. We are constantly called on to use the general principles learned from them. A knowledge of chemistry is absolutely essential in the engineering of the present day. A midshipman must have a reasonable understanding of the science of physics before he can successfully take up the study of marine and electrical engineering. Laboratory measurements, experiments and demonstrations as well as recitations are necessary. The Naval Academy has excellently equipped chemical and physical laboratories, but insufficient time is allowed for their use. No college or scientific school expects a student to acquire a working knowledge of these subjects in less than three times the number of periods allotted to the study of physics and chemistry at the Naval Academy. The study of sound, light and heat is closely allied to that of mathematics; it requires the midshipmen to think and, after all, the practice of reasoning is one of the best features of the Naval Academy education.

If enough time were given to mathematics to get it thoroughly ground in so the midshipmen could apply it successfully to the allied subjects, the time allotted to marine engineering and to navigation would be sufficient as it stands. This does not take account of the loss of time in mechanical drawing which is one of the branches of marine engineering; 112 periods is not enough; 160 periods would be nearer the necessary time. Incidentally, there is good authority that the army and outside concerns are glad to get our graduates because they are good in mechanical drawing. A blue print of a piece of machinery is not an enigma to them. This will not hold true when we begin to graduate the midshipmen with only 112 periods spent on mechanical drawing.

In addition to more time devoted to mathematics, and to physics and chemistry, more should be given to electrical engineering and to ordnance and gunnery.

It is pretty generally admitted that naval officers in our service are weak in electrical engineering. There are too many things on board ship that depend on electrical gear to allow this condition to exist. Lighting the ship, its ventilation, working the turrets and guns, supplying ammunition, interior communication, fire control, in fact the whole efficiency of the ship as a fighting

machine is so vitally affected by the efficiency of the electrical installation that we cannot afford to graduate midshipmen and leave them in an admittedly weak condition as far as electrical knowledge is concerned.

Ordnance and gunnery is in the same plight—there is simply not enough time to cover the subject properly. The head of the department states that it would require one-third more time than is now assigned to that department in order to send the midshipmen away from here well qualified.

COMPARISON WITH OTHER SCHOOLS.

During the past four or five months the writer has obtained data from many of the leading colleges of the country. While the information was very full, it is rather hard to compare these institutions with the Naval Academy on account of the different methods of teaching and marking. In making the comparisons engineering courses were selected as they bring in mathematics and engineering, and it was thought that allowance could be made for the additional subjects taken at the Naval Academy, subjects which are strictly professional and which are not taken at other schools. While we did not get everything sought for from the information sheets from these colleges, the following facts were established beyond question: (1) The entrance requirements are higher at all the colleges heard from than at the Naval Academy. (2) The mathematics at the academy is about the same as that of the other colleges. (3) The courses in engineering are about equally difficult. (4) Not one of the colleges has a course shorter than four years. (5) Two of the colleges; although having more rigid entrance requirements than the Naval Academy, do not graduate their students in engineering in less than 5 years. (6) Ten of the eighteen used for comparison have additional courses of from one to three years in engineering—this means after the preliminary four years of work.

We have at the Naval Academy the brothers of these college men. The average brain power here ought to equal that at the colleges. How then can we cover **thoroughly** the same ground in four years that they cover in an average of more than four years if the college students are better informed when entering college.

But we do **not cover the same ground—we cover much more.** The mathematics and engineering are about the same. The Eng-

lish and physics and chemistry are perhaps a little easier than in the engineering courses at other schools. But many things are covered here that engineering courses in colleges never touch, as for instance—navigation, astronomy, modern languages, seamanship, international law, ordnance and gunnery. How can we ever cover this extra work in less time than the other schools take when their men are better prepared at entrance. There is at hand a letter from a Naval Academy graduate so apropos that I must quote an extract from it: "I am a graduate of the U. S. Naval Academy, retired, and have been teaching twenty-five years. There is no doubt that your course should be one of five years for the best results to the student. Time is required to do good work anywhere. To teach students fundamental principles so that they cannot forget them even if they try; to teach students to do things, to originate, instead of copying, requires time."

LACK OF COMPETITION.

Competition at the Naval Academy was killed ten years ago with the advent of the big classes. It seems unnecessary to call attention to the value of competition. The wonderful improvement in gunnery and in engineering in the navy are examples of the result of competition. In the days when the commissions per class were but few, there was a scramble for them and the best man got them. The commissions were the reward of hard work and well cultivated intellect, and the graduates who got them were the thinkers of the class.

With the large classes came the need of a greater number of officers. We had to have them to man the ships. The midshipmen knew this and studied less. The marks went up; 2.5's gave way to 3.0's, for they all had to be graduated.

All this resulted in what was near kin to a union. The midshipmen realized that if the bright ones studied hard the ones who were "wooden" could not get through. It became bad form to "study out of study hours," and why not? It is against human nature to do more than one needs to do. The plane of marks was necessarily shoved up in order to supply our own needs, and, once up, it became difficult to lower. It is not my desire to go on record that these men will not make good officers. I trust they will, I believe they will if they work hard. This much, however, is certain; they must cultivate out in the service the thinking

power that they should have more nearly perfected while at the Academy.

Next year, unless the laws are changed, the large classes will cease to exist. This will be a bad thing for the Academy and for the service at large. The classes should be kept as large as they are now, but only the number needed to fill the vacancies should be commissioned. This would give a lot of education at the expense of the government, but the money would be well spent. Furthermore, the students who spend 5 years at the Academy, even though not commissioned in the navy at graduation, would be of great value in war time.

The Bureau of Navigation could decide how many are needed each year. Out of an entering class of say 300 there might be 100 or 120 to commission, and competition, one of the most powerful incentives ever used at the Naval Academy, or anywhere else, would help work out the Naval Academy problem.

AGE OF ENTERING.

The age of admission and the entrance requirements should be low for many reasons, among which are: 1. Algebra and geometry form the foundation of all mathematics; if those two subjects were taught here we could be sure the midshipmen have the proper foundation to build on. 2. The Naval Academy would get a more ambitious set of boys. Suppose, for instance, the lower age limit to be 18 years; most boys of that age who are ambitious have decided what they are going to do in life, and, even at 17 many of them have started the education that is to fit them for their life work. 3. The younger the midshipmen are the more impressionable they are and the easier it is for them to drop into the "Customs of the Service." 4. If taken, say on an average of two years younger, they could put in the additional year required for a proper education and still become commissioned officers two years and a half younger than they do now. The age of entrance is now 16 to 20, a mean of 18 years; add 6 years for the present course (cunting the two years at sea) and the average age for commissioning is 24 years. The Smith Bill makes the entering age 15 to 18, a mean of 16.5 years, add to this the 5 years which are need here and there results an age for commissioning 21.5 years, which is two and a half years less than the present age when commissioned.

SUMMING UP.

A five year course would give sufficient time in mathematics to properly fit the midshipmen for studying the other subjects taught here; it would give sufficient time in physics and chemistry, in ordnance and gunnery and in electrical engineering. It would give a total time of one year on summer cruises, which ought to furnish enough sea experience to justify a commission on graduation.

And if the congressmen and senators are allowed, after 1913, the same number of appointments they now have the percentage of commissions issued to a class at the end of 5 years would be small enough to keep alive the keenest kind of competition.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CRUISING IN FORMATION.*

Translated by COMMANDER R. R. BELKNAP, U. S. Navy.

A. STATION KEEPING.

Good station keeping is an indispensable fundamental condition for good and safe steaming in formation. This should be perfectly clear to every watch officer, and as a result of this knowledge every one of them should have the energetic determination to be always properly in position, and to improve continually in his manner of attaining this end.

A general principle is that an officer will steam better the fewer engine signals (*i. e.*, changes of speed or of the engine revolutions) he needs for keeping station. Beginners generally steam in a way much too unsettled. They are often too rash with engine signals, and still they do not keep in place. The reason in most cases is that they do not sufficiently take into account the inertia of the ship. They believe that any change in the speed of the engines should appear at once, forgetting that the ship always needs some time in which to take up the speed corresponding to the number of revolutions, both in case of increase of speed and of reduction. In forging up in column, for instance, they will wait too long before ordering the prescribed speed, as a result, shooting ahead by the excess momentum of the ship; then will considerably decrease the speed, and presently fall behind again by not increasing the speed again in time; and then when steaming up will again run too far ahead. Such unsettled procedure, by which the ship never becomes steady, is in the first place a cause

* Translation of a chapter on "Wrinkles for the Watch Officer" in the work on "Seamanship," by Vice-Admiral Dick, I. G. N., which is approved by the German Admiralty as a text book for use in their navy.

Certain references in the original applying only to triple-screw ships have been omitted in the translation.

of much strain on the engineer personnel, and it also makes a r
less consumption of fuel. Finally, it will in most cases be
municated to the rear in increased ratio, and is liable to unst
the entire formation.

For further details in this regard, see under (a) below.
cruising (*i. e.*, outside of evolutions or special manœuvers
is generally correct to use, not changes of rate of speed, but
changes of the number of revolutions; because the guide sh
steaming at a steady speed, and consequently there is no re
at all for any great change of speed, if sufficient attention is
In evolutions, on the other hand, this means will not be suffic
on account of the rapidly changing situations, and because
mistakes in regard to distance and bearing must always be r
fied as quickly as possible. It will very often be necessar
work with changes of the rate of speed (*i. e.*, from standar
half, or standard to full speed, etc.). Nevertheless, in perfor
evolutions, one should be as sparing as possible with or
When one begins energetically to educate one's self in
marked progress will soon appear. In general, the follo
maxims may be established for the guidance of the watch o
when steaming in formation:

1. Keep in station.
2. Manage with the fewest possible engine signals.
3. When cruising (*i. e.*, not manœuvering), work only
   small changes of revolutions.
4. In evolutions, use changes of rate of speed as may be n
   sary.

Good steering is, of course, of the first importance for
station keeping, as well as for good navigation in general.
watch officer must use great circumspection in choosing his he
men, and spare no pains in training them. When doing e
tions, the best helmsmen should always be at the wheel, bec
then good steering is of especial importance.

(a) *In Column.*—On the jackstaff, at suitable height, an
crossbar must be fixed, which, according to the height of
eye of the watch officer, cuts at a certain point on the stern o
next ahead (as, for instance, lower edge of stern anchor), v
the ship is accurately in station. In good weather, by clos
tention even a small shifting of this mark up or down ca
once be detected, and thereby any forging ahead or drop

30

mark. One may also very soon be able to see about what distance one is ahead or astern of station when the crossbar cuts at a certain distance above or below the point where it should properly be. Consequently, while cruising in favorable conditions of weather, one can in general entirely dispense with a sextant. In any case, the officer who has the watch should try to make himself as independent as possible in this regard, by constantly training his eye. In carrying out evolutions, on the other hand, two sextants must always be at hand. Remember that the above mentioned mark will vary with increased consumption of coal, and therefore that one must verify it anew every day.

For the night, an electric light shining very faintly must be arranged on the jackstaff accurately at the height of the crossbar, and the watch officer must know how this light is to be held in regard to the next ahead's lantern.

As also, very often, steaming is done at 400 meters * distance (for instance, before anchoring in a roadstead with a tideway), it is well to arrange, over the above mentioned crossbar, another smaller one, for steaming at 400 meters. For those occasions when the jackstaff is to be removed (clearing for action) a wooden substitute staff must be prepared, provided with a proper mark at equal height.

Steady and uniform steaming is a preliminary condition for good cruising in column. The leading ship must accurately hold the speed ordered, and every ship astern of her must carefully endeavor to vary as little as possible from that speed. Any great change is communicated generally in an increased ratio to the ship astern, and therefore, although the guide be steaming uniformly with standard speed, the presence of only one unsteady ship near the head or middle part of a long column may result in forcing the ships at the rear of the column to vary from full speed to slow or steerage way. Even stopping or backing has been observed in such cases. Figure 1 shows an instructive example of this. It gives a graphical representation of the changes of speed, according to the engine-room logs, of the ships of a squadron not yet trained, during a twelve hours' night cruise. Such conditions are, of course, extremely uncomfortable and prejudicial, both on the cruise and in the fighting line. They can only be avoided, however, when every watch officer fully appreciates the cause and with

*Usual distance was 300 meters when this was written.

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painstaking attention endeavors to steam steadily. For this, it is absolutely necessary to pay close attention continually to the speed signals of the ships ahead and to the behavior of the above mentioned mark on the jackstaff. Avoid also the frequently occurring fault of taking up too late a new increase of speed ordered, because of being rather too near the next ahead and wishing first to settle back somewhat. In such circumstances, if one waits until the mark on the jackstaff visibly shifts, one will generally fall much behind and will have to recover from this error by correspondingly increasing the speed. But such compensating costs time and coal.

Good attention to one's own speed signals and night indicators is also of importance. Have the man on station correctly instructed in these operations and have him always report, on change of speed, that the cones stand properly, or that the night speed indicator is properly operated. The next astern will feel grateful for the pains taken in this regard.

Uniform cruising of a trained squadron must be demanded under all circumstances, both for the cruise and for the line of battle. During a cruise, for instance, in a four hours' watch, for all the ships astern of the guide, only a small number of engine signals (for instance, a maximum of 10) under normal conditions should be given, and all the signals must require only slight changes of revolutions. Notwithstanding these, however, the ships must keep in station steadily. A good means for educating watch officers in this respect is for the commanding officer to have the watch engineer tabulate the engine signals given during the night, by watches, and then make these known to the officers concerned.

When cruising with screened lights and in fog, quiet and steadiness in the column are of especial importance. In fog, in the first place, a certain unrest is likely to make itself felt because some ship, not properly in station, seeks to get connection with the ship ahead and afterwards is compelled to reduce speed below the normal, in order not to come too close. In such case one must strive energetically to re-establish steadiness in the column as soon as possible. Steady cruising in fog is by no means difficult, if no great changes of course become necessary, nor any turning out for passing ships. Keep the fog-buoy of the ship ahead

between the bow and the fore bridge.* Of great importance is good operating of the search-lights. The stations to be taken and the duty to be carried out in fog must be regularly assigned by station bill for each division (electrician watch) and carried out without delay on the command "fog" (to be given also to the engine-room, under which come the electricians).

If, for instance, by one's own insufficient attention or by faulty handling of the speed signals of the ship ahead, you should get so close to the latter that danger of collision will arise, you must sheer out and reduce speed. But do not sheer out more than necessary, and return into the column as soon as possible. In a trained squadron, the necessity for sheering out should not in general occur.

(b) *In Line Abreast.*—Besides the proper distance, the proper bearing must also be kept. For keeping the proper distance, good course steering by all the ships (especially, of course, by the guide) is very important. Corrections of distance, when on correct bearing, are made by slight changes of course (in general ⅛ to ½ point is sufficient). One then steams over a somewhat longer course than the guide ship does, and therefore must increase the speed a little, in order to remain on the right bearing. Any changes of course of ½ point or more, it is best to communicate to the ship next away from the guide, by flag semaphore, in order to facilitate his keeping of distance.

The bearing must continually be verified on the alidade, and, if necessary, be at once corrected by increasing or reducing the speed. If both distance and bearing have to be rectified, one has mainly only to increase speed, if behind, or to decrease it or maintain it (according to the amount that the course is changed at the same time), if too far ahead.

Although by change of speed the other ships are not influenced, one must nevertheless endeavor to steam as quietly and steadily when in line abreast as when in column. To do so, it is necessary to act at once, as soon as you perceive any changing on the alidade. Especially beware of standing too far ahead. Also remember that the sight line of the alidade must be correspondingly shifted when making any change of course, and that a correct bearing can only be taken when the ship, for the moment, heads exactly on her course. Therefore, have it reported to you each

* 10 yards ahead of the stem with us.

time from the steering compass when the ship is accurately on, and use these moments for verifying the bearing.

(c) *In Line of Bearing.*—Steaming in line of bearing is generally found very difficult by the beginner; but as a matter of fact it is scarcely more difficult than steaming in line abreast, when one has fully grasped the nature of the line of bearing formation.

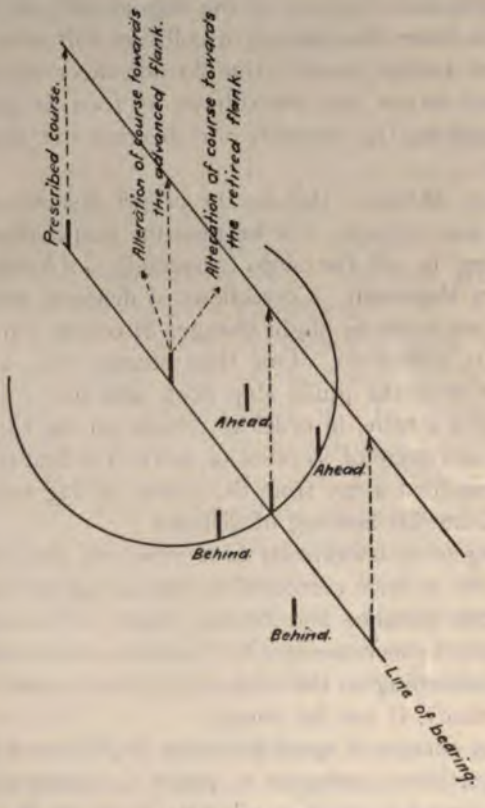

Figure 2

Changes of distance, when on correct bearing, are obtained by altering course by a certain amount (⅛, ¼, ½ point) and altering speed; but this change of speed, in contrast to the practice in line ahead, is either an increase or a decrease, according as the change of course is made towards the advanced or towards the retired flank. If the speed ordered be maintained unchanged,

then if a change of course be made towards the retired flank—which is the same as towards the normal to the line of bearing—the ship would forge ahead too fast; while by a change towards the other flank, she would fall back. This can be clearly seen from Figure 2. This must be clearly kept in mind when cruising in line of bearing. Of especial importance in any change of course towards the retired flank is the immediate reduction of speed, because otherwise one will very quickly get

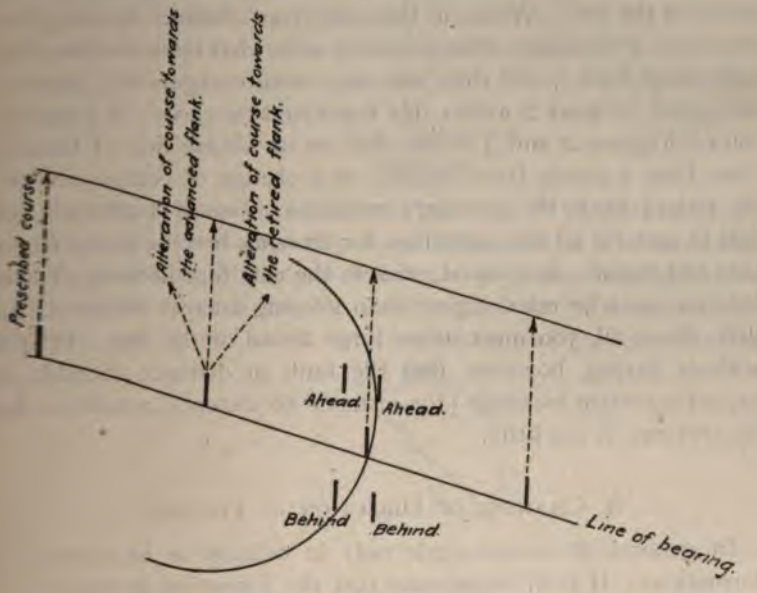

Figure 3

ahead of the line, which must be avoided absolutely. Small changes of revolutions are generally not sufficient in such a case; even in changing course by only ¼ point, one will, as a rule, be compelled to take a lower rate of speed.

In case one is too far ahead, yet at the correct or too great a distance, if one attempts to correct the bearing by only reducing the speed, one will make the distance too great. One must therefore at the same time make a change of course towards the advanced flank, paying sharp attention to the bearing, in order that the normal speed, in connection with the quick dropping back, may be resumed in time. If, when ahead of the line, you have

much too little distance, so that during the settling back you must at the same time head away somewhat from the guideship's course, a quick regaining of the correct bearing is possible only by a considerable reduction of speed, because of the conditions discussed above. If, on the other hand, you are too far astern and have the correct or too little distance, then by merely forging ahead up to the line of bearing you will get too close or still closer. You must therefore at the same time head off a little, and be careful with the increase of speed, in order to avoid getting ahead of the line. When, in this case, your distance is too great, you must, if necessary, change course somewhat towards the guide (advanced flank), and then you may more energetically increase the speed. Figure 2 makes this consideration clear. A comparison of Figures 2 and 3 shows that on an obtuse line of bearing (less than 4 points from abeam), in a change of course towards the retired flank, the necessary reduction of speed decreases, and that in general all the conditions for cruising become more favorable and easier. In general, stick to the rule that keeping correct bearing must be rated higher than keeping correct distance, and that, above all, you must never forge ahead of the line. It goes without saying, however, that the fault in distance should not exceed a certain measure (for instance 50 meters), notably when the distance is too little.

B. CHANGES OF DIRECTION OF COLUMN.

In general, these are made only in column or in compound formations. It is of importance that the formation be accurately maintained; hence, that each ship, immediately after having completed the turn of the number of points ordered, will see the masts of her file leaders in line and be at the proper distance. To this end she must turn in the same water and on the same arc as the leading ship does. An ugly fault frequently occurring, notably with beginners, is that the turn is made too late, so that, even by the use of the full helm angle available, it is in most cases no longer possible to avoid going outside the arc of turning of the guide ship. In such a case, since it is necessary in connection with the turn to get back again into the column, a more or less large arc is formed at the turning point (Figure 4), which quite appreciably impedes the turning of the ships following, looks very bad, and besides, on account of the longer track and the larger angle to be made, makes the line unsteady and breaks it up.

Very often the further fault is added, that, because the stern of the turning ship ahead deviates from the tangent, the course is not accurately kept, but her stern is followed outwards. The tendency to sag away is thereby substantially increased and cor-

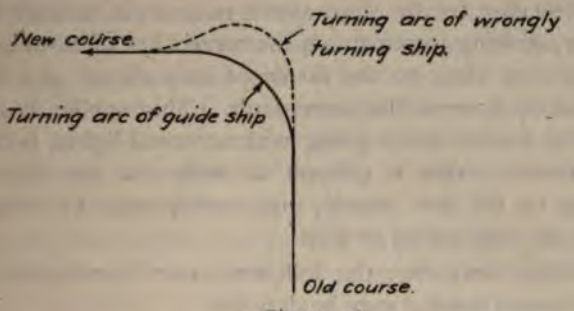

Figure 4

rect turning is almost impossible (Figure 5). The marked swinging out of the stern of the ship ahead makes at first a rather alarming impression at the normal distance with the modern long ships. It takes some time before the stern begins to return again to the tangent; and as one's own ship, on account of the loss of speed

Figure 5

of the ship ahead, will at first run up on her, a beginner is likely to think that there is danger of collision. In reality such is by no means the case, if one's own ship is properly in station; the ship, it is true, will approach rather near to the stern of the ship ahead,

but as soon as she begins turning, the distance will be opened again by her own loss of speed and the taking up of speed again by the ship ahead.

Once a too wide sweep has been made by the bad turn of a ship, it is not so easy for the ships astern to avoid it, because the direct follower, wishing to remain on the correct arc of turning, is likely to come very close to the displaced ship ahead, and is thereby often led to commit the same fault. This applies especially to the night, notably when going with screened lights, because then the darkness makes it difficult to make out the ships already standing on the new course, and consequently to recognize the fault of the ship ahead in time.

From the foregoing, the following rules for making changes of direction of column may be derived:

1. See that the ship, when the next ahead begins to turn, is kept as accurately in station as possible; on no account be appreciably too near. In order to avoid this, the speed, if necessary, must be at once reduced as required, at the hoisting of the turning signal. In large turns especially (of 8 to 16 points), too little distance is uncomfortable and likely to result in going wide.

2. Keep accurately on the course, as soon as the next ahead begins turning. If no suitable objects for the helmsmen are available ahead and it is not possible to depend sufficiently upon the steering compass (which is in the conning tower), on account of too sluggish movement, then have the course continually checked from the standard compass; and also, by day, look astern, in order to detect at once any turning of the ship by the deviation of the stern to the right or left from the rest of the column following after.

3. Begin turning at exactly the same point as the ship ahead, on the supposition of course that she turned correctly. In doing this the first few times, one must at once look for marks by which to fix the time for beginning to put over the helm. For the ships of the *Braunschweig* class (battleship, 13,000 tons), for instance, when one's own ship at standard distance is correctly in station and is holding the course accurately before turning, the following marks may be given:

(a) The passing of the flagstaff of the ship ahead through the jackstaff.

(b) The approaching of one's own bow to the swirl of the ship freely from the fore bridge. In a dark night, the time required for passing over the distance between the stern of the ship ahead and one's own bow at the known speed may furnish a good clue. The time counts from the moment when one observes the deviating of the stern of the ship ahead, by the moving of the stern light. Here also, one must be in station when this turning mark is used. Of course no absolute dependence may be placed on such marks, because they are influenced by faults in one's own position and in the turning of the ship ahead; but they are always a more or less good clue.

4. Keep your ship during the turning in such a way, be proper use of rudder, that the bow will always be somewhat within the wash of the ship ahead. For the ships of the *Braunschweig* class, a ship's beam is a good measure. On no account get outside the wake of the ships ahead.

5. Better begin turning too early than too late. Turning too soon may be easily rectified by easing the helm and, if necessary, reducing the speed. Turning too late almost always results in going wide and endangers the unity of the line. When, from any reason, the helm was moved too late, however, then at once apply a larger or the full helm angle, and energetically increase the speed, because otherwise one always drops behind. During the course of turning, notably during its last part, the observing of the angle between the column already formed on the new course and the midship line, from the conning station to the stem, will furnish a good clue to determine whether the ship with the helm kept as it is will still come around in time or not.

6. If you had reduced the speed before turning because too close, then, when beginning to turn or very soon afterwards, resume standard speed; otherwise you will be sure to drop behind. In some circumstances, even an increase of speed will be necessary.

7. When the ship ahead, by faulty turning, goes outside the arc of turning of the guide ship, then with all attention avoid repeating this fault. In such a case, take your direction from the ship preceding her, or if she be already out of sight, then from the line of the ships that have already turned, and, if necessary, bear a weatherly helm, in order not to come too close to the ship ahead. In turns up to 8 points in such a case, you may, without any fear,

head at first for the middle or even the bow of the ship ahead. If need be, there always remain the stopping of the inboard engine and a reduction of speed. When the fault of the ship ahead is great, you will in most cases range alongside of her at a pretty close distance.

8. When the ship ahead is turning correctly, then, before or during your own turn, only reduce speed if really necessary, because every reduction of speed means some disturbance of the ships astern. Also increase speed again as soon as possible, otherwise you will almost always get behind.

9. As the leading ship, one must after a turn at once come to the course accurately, because otherwise the manœuver will be made difficult for the ships astern, and the forming of the properly aligned column on the new course may be materially delayed. For aids to getting the ship on the new course quickly, see the remarks under C.

The correct and careful execution of turns (up to 16 points), is an excellent criterion for the seamanlike cruising of individual ships and of the entire squadron. It is therefore to the best interest of every watch officer to improve continually as much as possible in this undoubtedly not very easy art.

C. SIMULTANEOUS TURNING.

After a turn together has been carried out, the ships should at once lie correctly in the new formation. To secure this, the squadron helm angle must be exactly known, the turn must be begun promptly when the signal goes down; while turning, regulating must be done, by increasing or reducing the helm, as well as by changing speed, in case the ship were not in station when the turn began, or is getting out of station during the turn; and finally, uniform procedure must be observed on board all ships, in easing the helm and meeting her. After the completion of the turn, the position should be promptly corrected, if necessary, in order that the line may be dressed in the shortest time. With turns of 16 points when in column, this is not so simple, because in the first place it is difficult to judge whether you are outside the line to the right or to the left. Deception in this regard is possible notably when the guide ship does not at once get steady on the new course. It is best to observe by the double glass, during the steadying, what the approximate new line of

dressing will be, according to the position of the ships in front; then you will soon get a reliable clue for your own correction. The rapidity with which the line in such a case is re-established is also a good standard for judging the efficient handling of individual ships and of the squadron. Some indication as to the side to which correction will probably be necessary may be obtained also by taking a bearing of the new guide ship after turning 8 points. Any quick rectification of alignment, which of course must be made by every ship independently of the next ahead, becomes impossible, however, if the leading ship fails to steer a steady course at once.

When turning together from column to line, every ship ahead of the new guide ship must as soon as possible measure the distance from her former next astern, to see whether this distance is correct or not, and to be able still to make it up, if necessary, during the turn. For the same reason, when turning from line abreast into column, the ships lying between the old and the new guides, and the former guide herself, must at once measure the distance to the ship next towards the new guide.

In order that the watch officer may be able to make rectifications, and to ease and steady correctly, the last four points of simultaneous turns must be reported from the standard compass, always in the following manner: 4 points, 3 points, 2 points, 1½ points, ¾, ½, ¼, ⅛, Mark! When turning together 16 points also, this reporting of the turning by points is necessary. The final steadying on course is best left to the helmsman, giving the command: "Steady on the course," after meeting her and steadying. As stated above, it is desirable for the accuracy of cruising that, for easing the helm and meeting her in large turns together (4 points or more), the same procedure should be carried out on board all ships. In any case, within the ship, entire uniformity among the watch officers must be exacted.

D. To Anchor.

As a rule, anchoring is done in column or in a compound formation, seldom in line or line of bearing. The point is that, after anchoring, the ships may lie accurately in position. This can only be obtained if each ship endeavor to the utmost to be in station on the way to the anchorage, and to keep in station when reducing speed before anchoring. Any unsteadiness arising in

the column shortly before anchoring, by bad behavior of a ship, is extremely disturbing. This holds good especially for column, with which we are chiefly concerned. Close attention should therefore be paid to any forging ahead or lagging back, and any necessary correction of speed should at once be taken. A good angle taker should constantly observe the behavior of the ship and report. One's own observing of the crossbar on the jackstaff is, as a rule, not sufficient for the exact steaming that is necessary immediately before anchoring. Especially beware of being too far ahead, because this fault can be remedied soon enough only with difficulty, as the reductions of speed follow each other quickly. In case you are too close, when the signal "Stop, as soon as in station" goes down, the only means then available for correcting position is backing the screws, which, however, always means an offense against the ship astern of you and therefore should be strictly avoided. For the same reason, take care during the run with engines stopped not to still forge ahead of place, due to greater speed momentum. Good steering is, of course, very important for good keeping of station. In a well-trained squadron all the ships must anchor at about the same moment. It must not occur that the rear ships of the column anchor in succession, because of having kept somewhat back through overcaution, thus having to steam up to place after the leader has anchored.

E. WEIGHING ANCHOR.

After the anchor is aweigh, the ship must be kept on the same heading as before, until the signals about formation, course, and speed are hauled down. A frequent fault is that the rear ships start ahead too late, whereby at once the line will be lengthened out. It is of advantage to know the compass bearing of the line at anchor, because then the manœuvers necessary for carrying out the signaled orders about formation and course can be decided better.

F. DERANGEMENTS OF STEERING GEAR.

Although the entire steering gear is of course carefully examined daily before weighing anchor, and at least once daily while under way for a longer time than one day, cases of refusal or damage may occur, due to faults in operation or other causes.

The officer of the watch must therefore always know how to act in such cases. The necessary instructions are given in the proper place of the ship's regulations, in which the derangements to be expected in ordinary cruising, as well as in action, must be treated in detail. Each commanding officer will also make it his business to train the watch officers practically in this respect, by frequent exercises when cruising singly. It is to be observed from a general point of view, that, in case of any disablement of helm, one must at once endeavor to keep the ship on her course by means of the screws. If this appear to be impossible, on account of the position of the rudder or for any other reason (as for example, wind and sea), without endangering the safety of other ships or the continuity of the line, the prescribed breakdown signal must at once be given. The mere shifting from the steering engine (when the reserve steering engine is ready for use, as should always be the case in evolutions) must have been exercised so well that it can generally be carried out without making the breakdown signal and without any accident becoming apparent from outside the ship.

The watch officer is also responsible that his helmsmen shall be familiar with the steps to be taken in cases of disablement of helm, as far as they affect their stations. The call "Helm refuses" must not cause any commotion nor even momentary hesitation, neither with the watch officer himself nor with his helmsmen. On board a large ship there are usually, in addition to the conning tower, the following reserve steering stations, each of which are occupied by one man, and which can therefore be immediately used upon uncoupling the connections farther ahead: the central station, and the main or reserve steering engine spaces (according to the engine in use). The duties of the several stations must be definitely prescribed by regulations, carefully prepared and posted in the rooms in question, and the watch officer must continually care for sufficient instruction and oversight of the men.

In case of all those disablements of steering-gear in which men below decks have to steer, exact keeping of course or station by the assistance of the compasses provided in the lower steering stations will generally not be possible. The watch officer, in a similar manner to the case of steering with the screws, will have to observe the behavior of the ship closely and at once counteract

any incorrect steering by direct helm commands. The main thing is not to allow the ship to become unsteady but to keep her as quiet as possible. It will, of course, be further advantageous to call the attention of the helmsman to all circumstances affecting the steering of a steady course, as for instance, the effect of wind and sea.

G. FINAL REMARKS.

If the watch officer should get into a situation where there is danger of collision, it is above all important to get the stem pointed clear of the other ship, since touching with the side or stern is always less dangerous for either ship.

Further, the watch officer, when cruising in narrow waters should remember that each ship is responsible for her own navigation. Blind following in the wake of the ship ahead under such conditions is often dangerous, on account of drift by current or wind. Careful observing of current and wind, and making the necessary allowance for it, must be insisted upon.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ATHLETICS AND AMUSEMENTS OFFICE, FORT SLOCUM, N. Y.

By 1st Lieut. Paul D. Bunker, U. S. Army.

It having been suggested to the writer that due to the prominence of athletics in the Army and the Navy, and to the unique functions of the above named office filled by him, a description of some of the features of said office with respect to the manner of handling recruits at this post would be of interest to many naval officers, the attempt is made to set forth certain activities that are not prevalent at other Army posts.

In the first place, in order to form an idea of the conditions, it may not be amiss to state that Fort Slocum is one of the five recruit depots supported by the War Department. Practically all of the applicants for enlistment east of the Mississippi River are sent to Fort Slocum for final examination and acceptance or rejection, as the case may be.

The strength of the garrison varies, running as high as 1500 men, at times. The organizations at the post consist of the 1st, 2d, 4th, 6th, 21st and 25th recruit companies, general service, infantry, the first named being a band. Each company is composed of a certain neucleus of picked soldiers, termed the "permanent party," and of recruits. Incoming recruits are assigned to these companies as equally as may be, are given a course of instruction in the fundamentals of the military art and then shipped to their regiments as called for by orders issued from time to time by the War Department. This course of instruction is intended to cover a period of about two months, but a demand for recruits may shorten this time to a few days, as was illustrated during the Mexican border trouble. These recruits, due to the amount of drill, study, etc., required of them, are not

allowed to leave the depot during the first two months, which fact has considerable bearing on our policy of handling them.

The permanent party before mentioned consists of about 17 sergeants, 10 corporals and 25 privates for each company. From these are chosen the drill sergeants, extra and special duty men and all others on duty pertaining to the administration of the depot.

It is not the object of this paper to inquire into the methods of recruit instruction as regards purely military work, such as guard duty, etc., but to show what is being done in a certain department which should be equally interesting to Army and to Navy alike. The activities referred to are centered in the "Athletics and Amusements Office," which title is fairly descriptive of the work involved.

The general duties of this office are to supervise all forms of athletics on the post, and to provide means of entertaining the soldiers at times when they are not on duty. These duties will be discussed under the two separate heads indicated in the title to this paper.

I. ATHLETICS.

Of course, in the limited time at our disposal, it would be absurd to attempt making a finished athlete of the average recruit. The advisability of such results, even were they possible, is open to question. Therefore, the main idea underlying the athletic instruction of the recruit, is to "get him off his bunk" and to put plenty of fresh air into his lungs. Of course the regular "setting up exercises" are used in drill every morning, but that is considered insufficient. Hence, every Tuesday, Thursday and Saturday afternoon all recruits that are not actually on duty (guard, drawing clothes, kitchen police, etc.) are given two hours systematic exercise according to a prescribed schedule as noted below. Each company is allotted a certain portion of the parade ground, and the recruits exercise thereon, under the direct supervision of non-commissioned officers known as "squad instructors." Each of the latter controls about a dozen men, there being a selected sergeant in charge of the whole company who sees that each squad complies with the schedule ordered.

Now two hours is a long time, when an athletic drill is considered, and if the go-as-you-please method were allowed, the men

would be bored to death before the time was half over, and but little benefit would result. The principles involved in our solution of the problem can be seen from the following letter, which is, in tenor, a copy of that submitted by the athletics and amusements officer (hereafter designated as the A. & A. O.) on the 15th of every month.

RECRUIT DEPOT, FORT SLOCUM, N. Y., July 15, 1911.

The Adjutant, Depot,

Sir: In compliance with G. O. 13, c. s., Depot, I have the honor to submit the following schedule of exercise for the month of August, 1911:

1. The various company commanders will see that their squad instructors thoroughly understand the working of the schedule laid down hereafter, and will see that all apparatus or material required by the exercises is on hand.

2. The copies of "Indoor and Outdoor Gymnastic Games" provided are for the use of the squad instructors, who will conduct the exercises according to the rules therein.

3. Each squad will exercise on the parade ground under the supervision of its squad instructor; it will not leave the parade, or be joined to another squad except by direction of the athletics and amusements officer, or in case the squad instructor is unavoidably absent.

4. The non-commissioned officer in charge of each company's athletics will distribute his squad among the others present, and will devote his time to seeing that the squad instructors observe the schedule below.

5. After each day's exercise, the squad instructors will endeavor to have the men of their squads acquire the habit of taking a shower bath immediately after returning to their barracks.

6. The exercises for the month of August will consist of the following:

1. Boxing.
2. Medicine ball.
3. Football practice in kicking and catching.
4. Hurdles.
5. Pole vaulting for height and for distance.
6. High jumping, standing and running.
7. Soccer practice in dribbling and passing.

7. The above exercises are shown by their numbers in the schedule below, and will be performed by each squad in the rotation indicated. Duration of each exercise, 20 minutes. The non-commissioned officers in charge of each company's athletics will be responsible that the squads change from one exercise to the next at the proper time, and will use a whistle or other means of securing the prompt attention of the squad instructors.

8. Each company will exercise according to the following schedule:

No. of Squad.	Sequence of Exercises.		
	Aug. 1-10, inc.	Aug. 11-20, inc.	Aug. 21-31, inc.
1 and 6	1-2-3-4-5-6	3-2-1-4-6-7	1-2-3-4-6-7
2 and 7	2-3-4-5-6-1	2-1-4-6-7-3	2-3-4-6-7-1
3 and 8	3-4-5-6-1-2	1-4-6-7-3-2	3-4-6-7-1-2
4 and 9	4-5-6-1-2-3	4-6-7-3-2-1	4-6-7-1-2-3
5 and 10	5-6-1-2-3-4	6-7-3-2-1-4	6-7-1-2-3-4

9. At 2.30 p. m., all recruits who desire to swim will be assembled by the next-to-senior non-commissioned officer and marched to the bath house. He will preserve order in the line obtaining suits, and will see that all of his men return their suits when they are through using them. Men who do not care to go swimming will continue exercising on the parade, according to the above schedule.

Very respectfully, etc.

Advantages of this Method.—1. Due to the fact that the exercise period is divided into six parts, there is no difficulty in securing the necessary variety. Changing from one exercise to another serves to break up the time and make it seem much shorter than it really is. It thus serves as a very effective sugar-coating, for as soon as exercise becomes work, you cease securing the best possible results; hence it follows that you should keep the men interested, and unconscious of the fact that they are, in reality, doing good hard work. The variety of the work thus secured also enables us to avoid too much exercise with one particular set of muscles and to secure the all-round development of the recruit.

2. It fulfils the military requirement of efficient supervision. A glance at the schedule will show exactly what each squad should be doing at any particular moment.

3. By proper choice of exercises, it enables us to make a more efficient use of whatever ground space may be available.

4. Being compulsory, it brings out those men who are diffident. Most men dislike performing any athletic "stunt" when they know they cannot do it well. By this system their diffidence or backwardness is dissipated by observing that there are others equally unskilful.

In the selection of the exercises for this schedule a multitude of circumstances arise that closely circumscribe our choice. Especially is this true in winter, when the snow-covered ground renders many forms of exercise impossible. As another instance, running must be indulged in cautiously, as the effect of excessive

work in this line would be very detrimental to the average new recruit. The same applies to other forms of strenuous exercises. On the other hand, the work should be distinctly recreative in its nature, and dull treadmill exercises be avoided.

Therefore each exercise on the schedule is the result of much thought and deliberation. It is found that the best results are obtained from those exercises that are athletic in their nature (as distinguished from calisthenic) and that depend for success upon some knack, or that develop a spirit of rivalry. For example, good results are obtained from a judicious use of hurdles. The standard distances are laid off and two or three low hurdles placed at the proper intervals. A squad is allowed to negotiate them once according to their own ideas. After every man has managed to do this "stunt," one of the best hurdlers on the post is sent over the hurdles at top speed. The ease and smoothness of his performance contrasted with the slowness and awkwardness of that of the recruits never fail to make a profound impression and preach a sermon better than an hour's talk.

No matter how "soft" a man is, he can hardly hurt himself over a few hurdles. This particular exercise is good for the legs and abdominal muscles, it affects the "wind" to an unlooked-for degree, and is especially good in helping a man to "find himself." Also, practicing hurdles in this manner is a fair example of sugar-coated work; that is, while the recruit is being improved physically and is actually doing a fair amount of muscular work, this work being disguised as athletics, the man is cheerful and therefore gets much more benefit than he otherwise would.

Boxing is another exercise that is strongly favored, and is especially interesting to the men, there being some very creditable boxers among them, though they are fewer in numbers, perhaps, than in the Navy. To further the interest shown in this particular exercise, we hold monthly boxing exhibitions during the colder months, consisting of four or five "preliminaries" of four rounds each between such soldiers as may desire to compete. These bouts are run according to the rules of the Amateur Athletic Union. We also usually engage a couple of professionals from New York City to go on for six or ten rounds in order to give the men an exhibition of how it really should be done. The soldier contestants are allowed a small sum of money with which to buy the "rub-down" and other minor adjuncts in which the amateur

mind delights. The contestants for the main bout are hired for whatever we have to pay, and no distinction is drawn between the winner and the loser; they receive equal wages. We are very careful to comply with the laws of New York on this subject, in order to leave no loophole of attack by outsiders claiming that we run prize-fights.

No admission is charged to these exhibitions, all members of the garrison being freely admitted. All those who desire to contribute toward defraying the necessary expenses of these exhibitions are given an appropriate souvenir of the occasion. Deficits are paid by the post exchange, which finances all athletics and amusements at the post. These contests are largely attended by enthusiastic audiences, and to prove that there is nothing objectionable about them, many officers' families habitually attend. No outsiders except personal friends of officers and enlisted men are allowed in the audience, and in the latter case these friends are allowed to enter only upon special permission from the A. & A. O. in each case.

In view of the fact that practically all officers are thoroughly familiar with the subject, nothing need be said of the advantages of boxing as a form of muscular and mental training.

To supplement the "company athletics" held thrice weekly, we hold a monthly field (or indoor) meet, in which are seen the results of the training and exercise given the recruit during the month. Here is a typical order organizing one of these meets.

General Orders No. 84.

RECRUIT DEPOT, FORT SLOCUM, NEW YORK, August 29, 1911.

1. A Track and Field Meeting will be held at this Depot on September 26, 1911, commencing at 1.30 p. m. The contestants will be recruits selected from the several recruit companies by their respective company commanders.

2. The order of events will be as follows:

Events.	No. of contestants from each company.	Points. 1st.	2nd.	3rd.
1. 100 YARDS RUN, (Trials)	4			
2. 220 YARDS HURDLES, (Trials)	4			
3. SHOT PUT (16 pounds),	2	5	3	1
4. 100 YARDS RUN, (Semi-finals)				

	Events.	No. of contestants from each company.	Points. 1st.	2nd.	3rd.
5.	220 YARDS HURDLES, (Semi-finals)				
6.	POLE VAULT, (1st Height to be 7 feet)	2	5	3	1
7.	880 YARDS RUN,	4	5	3	1
8.	100 YARDS RUN, (Finals)		5	3	1
9.	220 YARDS HURDLES, (Finals)		5	3	1
10.	ONE MILE RELAY RACE,	4	5	3	1

3. The Athletics and Amusements Officer will have on hand at the field, the necessary lists of entries, tapes, watches, etc., required for the use of officials, who will procure same from him.

4. The non-commissioned officers in charge of each company's entries will report at the Athletics and Amusements Officer's Office at 11.00 o'clock on the morning of the meeting to receive their instructions and the numbers for their contestants. After these numbers have been given out no change in assignment of the same will be made except by the authority of the Referee.

5. Entries of each company, written on a single sheet of paper, will be sent to the Athletics and Amusements Officer by 9.00 o'clock a. m., on the day before the meeting. These lists will show the Christian name and surname of each contestant.

6. Running pants and running shirts will be worn by all contestants. No contestant will be entered in more than two events.

7. Contestants will be sent to the field under the charge of a non-commissioned officer who will cause the proper contestants in each event to report to the Inspector in the prescribed uniform promptly upon the "first call" for that event by the Clerk of the Course.

8. All officers and enlisted men not actually and unavoidably on duty will attend the meeting.

9. The rules of the Amateur Athletic Union will govern.

10. Officials will inform themselves as to their duties.

OFFICIALS.

* * * * * * * * *

BY ORDER OF MAJOR DUGAN:
H. B. CROSBY,
Captain 14th Cavalry,
ADJUTANT.

It will be noted that the company commanders *select* their competitors. That is, they try out the recruits of their companies and may require the best of them to enter the meet, regardless of the

personal wishes of the men concerned. No prizes are offered at these field meets. The results are announced in general orders, showing the number of points secured by the contestants of each company, in addition to the usual form. This helps cultivate a feeling of friendly rivalry among the various companies.

In our case, *esprit de corps* is harder to maintain than in the average organization, except, perhaps, among the permanent party men. This can readily be understood when it is remembered that the personnel of each organization, being composed almost entirely of recruits, experiences complete changes at very frequent intervals.

However, in spite of disadvantages, we manage to make a fairly creditable showing, as a glance at the following list of post records will testify. This list has been compiled from this year's field meets only, since it has but recently become the rule here of complying with the requirements of the Amateur Athletic Union in the matter of recording performances. To be sure, none of these records would last long at the average college, but it should be remembered that we are not training college athletes, but soldiers; and even if we were, one or two months will rarely make a record man from raw material.

POST RECORDS—FORT SLOCUM, N. Y.

100 yds. dash, 10-3/5 sec., Rct. Wm. T. Lemieux, July 25, 1911.

220 yds. dash, 25-2/5 sec., Rct. G. Minkler, September 15, 1910.

440 yds. dash, 57 sec., Rct. L. C. Devlin, September 15, 1910.

880 yds. run, 2 min. 2-3/5 sec., Rct. W. E. Bagley, October 20, 1910.

Mile run, 5 min. 9-3/5 sec., Rct. H. Butterworth, June 11, 1911.

40 yds. indoors, 4-3/5 sec., Rct. H. Arnold (twice) March 23, 1911.

120 yds. hurdles, 20-4/5 sec., Rct. C. R. Shaw, October 21, 1910.

220 yds. hurdles, 30-1/5 sec., Rct. T. Rielly, June 22, 1911.

Running high jump, 5 ft. 4-1/2 in., Pvt. R. O. McKeeby, May 26, 1911.

Running broad jump, 17 ft. 11 in., Rct. B. Smith, May 26, 1910.

Shot put, 16 lbs., 35 ft. 8 in., Rct. H. J. McGrath, September 15, 1910.

Pole vault, 9 ft. 6 in, Rct. J. Sebastian, October 21, 1911.

Athletic Teams.—During the winter months each of the five companies supports a basketball team. A regular schedule is made out in the A. & A. Office and the games are played twice a week. Last winter a fifty-game schedule was played—each team playing every other team five games. The winning company was presented a handsome silver cup. This year the number of games will be cut down to forty, in order to avoid interfering with the start of the baseball season. We had no team representing the post.

Last fall association football (soccer) was instituted among the regular games, and a team organized from each company. These teams played a forty-game schedule, and another silver cup was given to the winner. This game gives plenty of exercise to a considerable number of men, and is not especially expensive to support —much less so than is baseball. Injuries to the men are of rare occurrence.

The Rugby or American game of football was represented by a post team, and seemed to take better than any other form of team work, despite the havoc wrought by recent changes in the rules. Our team lost but two games, one being to the U. S. S. *Connecticut*.

During the summer, each company is represented by a baseball team, in a forty-game schedule arranged for two games per week. In addition to this, the post team played on Saturdays and Sundays against outside teams. We had no trouble in filling our schedule of about forty games, with good teams that were willing to come to Fort Slocum for their travelling expenses and no other "guarantee." These expenses were paid by the post exchange, which also furnished us all suits, etc.

All of the above games are played partially with the idea of giving the men some recreative and interesting exercise, but since the number that can indulge in them is comparatively limited, the main object is to interest and amuse the great body of recruits that are not playing.

II. AMUSEMENTS.

Under this head are considered all functions of the A. & A. Office that are not purely athletic in their nature. In the discussion of these matters the writer will endeavor to give such

data as will help anyone to determine whether or not it would be advisable to institute similar activities at the station (or ship, where applicable) at which he may be serving.

During the winter months we have some function or other at the "Drill Hall" every evening of the week. In the summer, when the men can get more exercise out of doors, and it would be too hot for indoor games, only two evenings per week are given over to entertainments in the drill hall.

Moving Pictures.—A moving picture show is given twice a week in the drill hall, throughout the year, for the amusement of the recruits, though everybody at the post is welcome. Indeed, many of the permanent party rarely miss a show, and the officers' gallery is usually crowded. Our "theatre" is an extemporized one in the drill hall: an operating room constructed on the gallery floor, and about 450 folding chairs of the settee pattern, which latter are also used in connection with all the other entertainments in the hall. Our curtain drops from one of the roof trusses and is rolled up when not in use. Our equipment consists of a Beseler stereopticon with right-angled carbons, the lower lamp being on rails to permit its being used with the moving picture "head." The latter is an Edison Underwriters' Model, Type B, with a "two-wing, inside shutter," which gives satisfaction. Our throw is about 63 feet and our picture about 13 by 18 feet. A competent soldier as operator is giving satisfaction. The fact that circumstances require us to use alternating current makes it hard for any except expert operators to get superlative results as far as illumination of the picture is concerned. Users of d. c. are comparatively free from these troubles.

We hold these shows on Tuesday and Friday evenings of each week, and four full reels are run at each show. We also put on four illustrated songs, and this is what necessitates the stereopticon. Sometimes we run two vaudeville turns instead of the songs, single acts "in one" being the rule. For this purpose we erect a portable stage in front of the curtain, using one of the sections of our boxing platform. All talent, films, etc., are obtained from New York City, from certain agencies that have been found to give us the best satisfaction.

The above program, including five minutes intermission for the benefit of the inveterate smokers and others, averages about 2 hours. An admission fee of ten cents is charged, "canteen

checks" being accepted. Our tickets are in rolls as usual, the tickets of each roll being numbered consecutively, and the rolls being of different colors to prevent fraud. When the men enter, their tickets are torn in half, the numbered end is presented to them, and the other half deposited in a box the key to which is kept in the possession of the A. & A. O. This is to prevent anybody from using the ticket over again. As we have an intermission at every show, the numbered halves of the tickets serve as door checks. This method is less troublesome, though perhaps less efficient than having regular door checks.

The slides for announcements, etc., are made usually on transparent gelatine bound between the usual plain glass plates. An outfit can be bought from any of the established dealers for $3.00, which by the way is exorbitant. These strips of gelatine will melt if left too long under the influence of the heat of the arc. Another very simple way is to write your notice on a plain glass slip with Chinese white, which of course will be rubbed off in a short time, but is good enough for emergencies. A better way is to use opaque marl, which can be obtained with full directions from any dealer in photographic supplies.

Piano music makes a most agreeable accompaniment to the pictures, *provided* your pianist is really good. The same can be said of a trap-drummer. In moving picture circles you hear much talk of "jackass music." This term is easier to illustrate than to define. When you are showing a weepy scene with the poor heroine leaning over her dying che-e-ild, and the idiot at the traps thinks it is a good time to try his "baby-cry" squawker —that is jackass music. When the Spanish girl dies, through a hundred feet of film, all to the strains of a lively Fandango and castanets—another case of jackass music. But properly handled, a piano and a good set of traps will add immensely to the attractiveness of a show.

There are numerous tricks in this trade, many of them most interesting, but space prohibits further dilation. The average reader, thinking perhaps of the advisability of securing an outfit for his post or ship, is more interested in the financial side of the proposition. With us, the installation is paying for itself, but that was about all until the last few months, when the average attendance has substantially increased, and bids fair to give better returns. There are several reasons why large returns are not

realized, the principal of which is that only one exhibition of each collection of reels is made. In civilian life a dozen or more "shows" might be given for the same expense of film rental that we are paying. We show each film but once, the four reels making up one show. These reels cost us $2.00 apiece for each night. Our expense account for one show would run about as follows:

Film rental	$8.00
Pianist	5.50
Singer (furnishes slides)	5.50
Operator, soldier	1.00
Salary, attendant, pro rata share	1.12
Electric energy (0.05 per kw.-hr.)	0.20
Fare of messenger for films	1.00
	$22.32

In case vaudeville is substituted for illustrated songs, the cost would be $28.82, as we pay $6.00 for each single turn. We rent our films from a certain "licensed" exchange which, after considerable experimenting, we have found will give us the best value for our money.

Due to a variety of causes, we formerly averaged but slightly over 300 paid admissions, but during the last two months we averaged better than 400. In this connection, however, it should be remembered that many of our recruits, having just arrived, have not yet received any pay. At other stations the attendance might be larger, especially at an isolated post, or on board ship, where you could rely upon an attendance of nearly the whole personnel that happens to be off duty. Excluding the 500 chairs, our outfit cost about $600.00 installed ready to run, so it can be seen that while this enterprise is not exactly a get-rich-quick scheme, it is reasonably sure to yield a good profit on the money invested. Take our case; charging all expenses against the receipts for the last eight months we show a clear profit of $315.00, not considering first cost of the outfit. In many cases the above list of expenses could be curtailed, but whether or not this would be a profitable venture for the average "canteen" with a limited supply of surplus capital is a question that would have to be settled separately in each case. The effect of outside competition would have to be reckoned with, in the case of almost all stations ashore. About the only way to compete is to beat your opponents in the

quality of show you give. We are so near New York that even if we didn't particularly care to, we must throw a good, clear, steady picture or none at all. Not that all New York shows have good pictures, but the idea is that we must be as good as the best, otherwise the recruits who know good shows when they see them would "knock" and keep other men away. This necessitates hard work, but comparison with the best has shown that except for infrequent occasions we project as good a picture as any house in the city. With the enlisted experts in each arm of the service available, this is not an impossible task. The Army and the Navy are better situated in this respect than the civilian exhibitor. Apparently the Navy has no trouble in handling this proposition, as we have noticed at the "exchange" where we get our films large consignments of films for several ships of the Navy.

Roller Skating.—If returns on money invested are desired, roller skating is about as good a venture as can be desired, at least it was found to be so in our case.

In December of last year we bought 100 pairs of the best rink skates obtainable. They cost $320, and "took" so well that 50 additional pairs were bought about a month later. The main floor of the drill hall, about 80 by 150 feet, was given over to skating from 7 to 9 p. m. on Wednesday, Saturday and Sunday nights and from 2 to 4 p. m. on Sunday afternoons. To keep out objectionable characters from nearby towns, only enlisted men were allowed on the floor. At first a charge of 10 cents per hour was made for use of skates, but later the time was shortened to one and a half hours with a charge of 10 cents for the whole period. By the end of April the whole sum invested, including cost of repairs, spare parts, and extra pay of attendant, had been recovered, and next season the receipts will be practically "velvet" for the post exchange. Rules for running rinks and regulating skating can be found in Spalding's Roller Skating Guide, which will be a help to anyone embarking on this proposition, but there are many things concerning it that can be learned by experience alone. We used the roll tickets for this amusement as in the case of the moving picture shows, but they were of a separate color. When handed in at the door they were torn up and put in a locked box. Music was furnished throughout the skating by an orchestra, selected from the band, with brass predominating in order to be heard above the roar of the skates. The orchestra

received no additional pay for this work, for it was in lieu of the outside concerts that they play during the warmer months. Any soldier owning skates is allowed to skate at these regular hours without charge.

Any person who has tried this form of amusement knows that it is fairly good exercise, especially for the lower part of the body. It takes well with the men, but would probably be less popular without the music, and more so if women were allowed to skate. We have about two hundred chairs arranged against the wall for spectators, and as we use these chairs for moving picture shows, etc., it is not necessary to move them out of the hall. This gives ample seating capacity for the skaters and such of their friends and relatives as come to observe. Most of the skaters are men who have learned before they enlisted, but many beginners also are seen on the floor. The returns from this form of amusement indicate its popularity. This popularity holds out well in the spring and early summer months, but, as before stated, the recruit is required to remain on the post for his first two months. Probably, if our recruits were not required to remain on the post as they are, during the summer months the various summer resorts, minature Coney Islands, etc., would prove strong counter attractions. As it is, this and the other features described are results of their detention, not causes. That is, we try to amuse the recruit and keep him occupied *because* he is kept on the post. These features are for his especial benefit, and not for the permanent party man who can leave the post whenever off duty, though we also try to make things attractive enough to hold the latter against the outside attractions—and succeed fairly well.

Bowling.—We have four bowling alleys in the basement of the drill hall which are continually in use except during the warmest months. There are also several alleys in the Y. M. C. A. building, which is a gift of Mrs. Russell Sage. Formerly a small charge was made for the use of the former alleys, but this has long since been abolished, though they were used as much then as now. It takes one man working for a fair part of every day to keep these alleys in the best possible shape. If it is desired to start a set of alleys at a station, our figures seem to show that it would be a very profitable investment for the average post exchange, although the running expenses are fairly high.

Shooting Gallery.—Adjacent to the bowling alley is a well equipped shooting gallery, with the usual array of moving targets, bull's-eyes, clay pipes, ball jets, etc. This is quite popular with the men, especially during the winter months when entertainments are being held at the drill hall every night. At such times the net receipts have averaged close to $4.00 per day. The post exchange having installed this gallery, it of course reaps the financial reward from same. The outfit, including motor, etc., complete, cost about $300 installed ready to run. Apart from the benefits accruing to the men, the above shows that this gallery is a valuable and reliable source of revenue to the post exchange. No competitions for prizes are held, but if they were, of course the receipts would be correspondingly increased. By this means, if necessary, it is believed that a well equipped shooting gallery could be made a well paying investment for almost any post exchange.

We use the service Springfield rifle and adapters for cal. .22 short ammunition. The latter costs about $18.75 per 10,000 rounds and the men pay one cent per shot. We have just added a revolver to our equipment, and it seems fairly popular. The use of silencers might be an improvement, but has not been tried as yet. Dry cartridges are best for revolvers and greased cartridges for rifles. Difficulties arise in connection with the continued use of the adapters or "cartridge holders," and we are asking the Ordance Department to make us a few rifles as nearly as possible identical with our Springfields, yet obviating the use of adapters.

Swimming.—The post exchange has purchased 150 bathing suits of very good quality, which are available for free use by the recruits of the garrison during certain hours. This innovation is extremely popular with the men, and we could easily use twice the present number of suits. No definite course of instruction in swimming is given, but it is hoped we shall be able to take this up next year.

CONCLUSION.

The foregoing is an attempt to show what we are doing for the recruit. We realize that there are many imperfections in our methods, many places where improvements can be made. We intend to make those improvements as fast as circumstances will permit.

In every such step there are considerations not apparent to the casual observer that must be carefully weighed and examined on every side before the final step is taken. We are trying to build up a broad and definite system that will stand the test of time and endure, and for such work "Make haste slowly" is as good a motto as that adage beginning "He who hesitates."

It is believed that the A. & A. Office at Fort Slocum is unique, in that its activities are wider in scope than any other similar office in military or naval circles. It was partially for this reason that the above was written, and also with the hope that some of the facts above noted might be of use or benefit to others, thus saving them the necessity of learning by experience.

THE FUNDAMENTALS OF NAVAL TACTICS.

By Lieutenant Romeo Bernotti, Italian Navy.

Translation by Lieutenant H. P. McIntosh, U. S. Navy, Retired.

CHAPTER III.

Tactical Evolutions.

48. *Tactical Evolutions and Maneuvers.*—Let us consider a compact fleet with the units grouped in the manner deemed to be expedient for tactical action, and at the distance from each other which is established as the normal.

In contact out of range the objective of the movements may be that of delaying offensive contact, or of taking a determined position with respect to the enemy, arriving at offensive contact with an advantageous alignment. In general the tracks must be rectilinear. At intervals of time it may be necessary to execute changes of course or of alignment; that is to say, to perform evolutions; the fleet may then be ordered with the maximum exactness, and the control may be completely exercised by means of signals.

In offensive contact we find ourselves under conditions different from those just indicated; we ought to have *at every moment* an opportune alignment and a suitable inclination of the ships to it; therefore, in general (as has already been pointed out in section 17), an immediate and continuous adaptation of the proper maneuver to that of the enemy is desirable. Limited confidence can be placed in signals, because, aside from other things, they require for their transmission a time that is not inconsiderable, even when use is made of repeating vessels not stationed in the line. In order not to be surprised and disconcerted, it is then necessary to be prepared to maneuver on the basis of simple *directives*—each division imitating the movements of the one immediately under the orders of the commander-in-chief; and, analogously, the single ships of each division regulating themselves by the one among them that is charged with the conduct of the maneuver.

We must, then, necessarily admit that the evolutions cannot, in general, satisfy the necessities of offensive contact, reflecting (as already results from section 33) that they ordinarily require two changes of course of considerable amplitude, which disturbs the firing; moreover, when an evolution is ordered, it is necessary to

foresee what will be the tactical situation at its end, or, after a time that is notably long, when the naval force is numerous. Such a length requires the prevision alluded to, and, on the other hand, renders it very difficult—the enemy being free to maneuver according to his desire. It is to be observed that, naturally, this prevision is also necessary when an evolution is ordered in contact out of range; however, if in the course of the evolution we do not arrive at offensive contact, we may, at least in part, nullify the effects of an erroneous prevision, by so regulating ourselves as to delay the approach. Finally for the duration of the evolution, the movements of the single units are restricted; and it is clear that this restriction cannot permit the best employment of the weapons and satisfy the variability of the tactical situation. Let us, then, admit the principle that *in contact out of range we perform evolutions, and in offensive contact we maneuver; having, in the latter case, as little recourse to evolutions as possible.*

Definitions.—We shall call *tactical evolutions* those proper for the government of a fleet in contact out of range, thus distinguishing them from the multiplex evolutions that can be imagined.

Under the name of *tactical maneuvers* we shall include those maneuvers that are required for the control of a fleet in offensive contact.

In this chapter we shall study tactical evolutions, considering successively the hypotheses that the fleet may have a simple alignment and a double alignment. We shall subsequently refer to the case of separated groups in contact out of range.

49. *Evolutionary Speed—Reserve of Speed.*—As is well known, to the end that a ship may keep in the formation it is necessary for it to have a *reserve of speed;* or, the *normal speed* must be somewhat inferior to the maximum speed of the slowest unit. On the other hand, in order to render the evolution as rapid as possible, it seems to us well to establish that, as a general rule, the evolutionary speed shall always be equal to the said maximum speed of the slowest unit. Consequently, when, for instance, we say that *the evolution is performed with the speed ratio of* $\frac{1}{2}$, it is established that the pivot ship reduces its speed, not to one-half of the normal speed, but to one-half of the evolutionary speed.

The minimum reserve of speed that each ship in the formation should have at its disposition must be a fraction determined by the normal speed; or, it must be of greater value the higher is the

normal speed; in fact, a ship that is not exactly on the desired line of bearing, in order to get into position, determines *by eye* the small change of course necessary; but, as equation (3) of Chapter I shows, the amplitude of the change of course—and hence the time required to get into the formation—depends upon the ratio between the normal speed and the evolutionary speed, and not upon their difference. Let us admit that the minimum reserve of speed may be defined by the ratio

$$\frac{\text{normal speed}}{\text{evolutionary speed}} = \frac{9}{10}.$$

50. *Evolutions to be Considered for a Simple Alignment.*—In relation to what we established in section 18, let us consider a naval force composed of two elementary alignments, each of which does not contain more than six ships. Let the naval force be upon a single line of bearing.

As we said in section 12, the formation has of itself no importance. Having admitted this idea to be fundamental for offensive contact, we ought to take it *a fortiori* as a guide in the study of contact out of range. In the latter, given the objects that we may decide upon, the first element to be determined in relation to them is the course; when the alignment is adjudged to be satisfactory, or when a change of course is urgent, such change is made simultaneously.

This said, let us suppose that the fleet has the proper course, which we will call the *advantageous course,* and that it is desired to change the alignment. The evolution to be performed consists in a change of polar bearing, which may be executed by one of the following methods:

1st. By changing course in succession (contromarcia).

2d. By oblique courses.

3d. By methods based upon the wheeling of the single column.

51. *Change of Course in Succession.*—In order to satisfy tactical necessities, from among the ways in which this method may be applied, we should select the one *that permits of losing the least distance in the direction of the advantageous course.*

The problem being thus set forth, it results therefrom that the transitory courses during the evolution should not make with the advantageous course an angle greater than 90°.

Let $A_1 \ldots A_n$ (Fig. 26) be a line of polar bearing α. A_1Z being the initial course—which we will suppose to be the advan-

tageous course—the transitory course must be included in the semicircle X_1ZX_2, X_1X_2 being normal to A_1Z. Desiring, then, to assume an alignment Y_1Y_2, it is to be observed: 1st, that it is not well to execute the evolution *in inverse order;* that is to say, by changing course simultaneously in the direction A_1A_n, which is without the said semicircle; 2d, that, for the same reason, in the evolution in direct order, that is, changing course simultaneously in the direction A_nA_1, it is not well, after such change, to execute the change in succession in the direction A_1Y_1, although the angle TA_1Y_1 is smaller than TA_1Y_2.

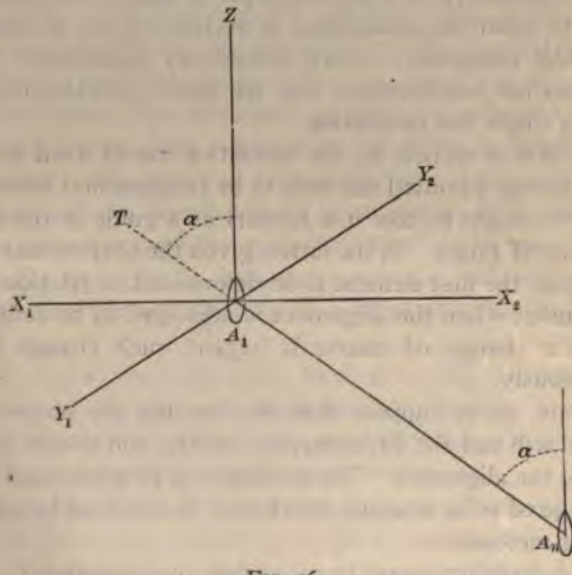

FIG. 26.

The rules for the evolution are hence the following:

1st. The ships change course simultaneously through the angle toward the ship farthest advanced in the direction of the advantageous course, resulting thus in a column of vessels.

2d. The leading ship, followed in succession by the other ships, changes course in the direction of the new alignment which makes the minimum angle with the advantageous course.

3d. When the last ship has completed the turn in the wake of the leading ship, the ships change simultaneously to the advantageous course.

It is to be noted that the change of course in succession, which constitutes the second part of the evolution just described, can be executed at evolutionary speed rather than at normal speed, because a ship that may have fallen slightly behind may put itself exactly in position by not following exactly in the wake of the one that precedes it, when it makes the turn.

52. *Oblique Courses.*—With the method by oblique courses, as has already been said in section 33, the extreme ship toward which the alignment inclines, reduces its speed, and the ships change course through an angle given by an appropriate table. If the angle of the change of course were estimated by each ship, that is to say, if it were not sought to determine it with the aid of a table or an instrument, it could only result in the employment of a longer time for the evolution, without any gain in simplicity.

The angle of the change of course could be determined as indicated by Admiral Morin in his profound work entitled *Degli ordini e delle evoluzioni di' un' armata* (*Rivista Marittima*, 1873-1874); but even in that case the evolution would not be completed in the minimum time.

It might also be prescribed that the intermediate ships of the formation should regulate their speed so as to arrive simultaneously on the new alignment; but the reasons for so doing are insufficient, while, on the contrary, for the case in which it is necessary to confront an unforeseen situation, it is preferable that each ship should arrive on the new alignment as soon as possible, as was proposed by De Gueydon.

The maximum value of the speed ratio that can be adopted in evolutions must be inferior to the value $\frac{9}{10}$ established in section 49; that is to say $\frac{8}{10}$. On the other hand, as we have already said in Chapter I, the minimum value that can be adopted for this ratio is $\frac{1}{2}$.

This being the case, it seems logical to perform evolutions with the ratio $\frac{1}{2}$ when the rapidity of the evolution is principally required, and adopt the ratio $\frac{8}{10}$ if rapidity must be sacrificed to the condition of losing the least distance possible in the direction of the advantageous course; it is well, however, to make a few reflections in this connection.

Let us indicate by V_A the evolutionary speed, and by V_B the speed of the pivot ship. Let t' and t'' be respectively the times

employed in a change of bearing of an amplitude ω with the values $\frac{1}{2}$ and $\frac{8}{10}$ for $\frac{V_B}{V_A}$. By formula (6) of Chapter I we have:

$$\frac{t''}{t'} = \frac{V_r'}{V_r''}. \qquad (1)$$

V_r' and V_r'' being the relative speeds corresponding to t' and t'' that are deduced by the formula in section 31, which gives V_r; this formula can be written:

$$V_r = V_A \sqrt{1 + \left(\frac{V_B}{V_A}\right)^2 - 2\frac{V_B}{V_A}\cos\delta},$$

in which δ is the angle of the change of course given by equation (3) of Chapter I as a function of $\frac{V_B}{V_A}$ and $\beta_1 - \frac{\omega}{2}$; β_1 being the polar bearing on which the ships are found with respect to the pivot ship at the beginning of the evolution.

In the time t'' necessary for the evolution with the ratio $\frac{8}{10}$ the space passed over by the pivot ship, which we will indicate by p'', is given by

$$p'' = 0.8\, V_A t''.$$

Let us bear in mind that $\frac{9}{10} V_A$ is the normal speed; consequently, if the evolution is performed with the ratio $\frac{1}{2}$, the track p' of the pivot ship in the time t'' is evidently

$$p' = 0.5\, V_A t' + 0.9\, V_A (t'' - t');$$

and hence we have

$$p'' - p' = \left(0.4 - 0.1\,\frac{t''}{t'}\right) V_A t'. \qquad (2)$$

Let us indicate the ratio $\frac{p'' - p'}{V_A t'}$ by u; the values of $\frac{t''}{t'}$ calculated with formula (1), and those of u, which are obtained by means of (2), are assembled in the following table in which $\beta_1 - \frac{\omega}{2}$ is made to vary from 0° to 90°, bearing in mind that with supplementary values of $\beta_1 - \frac{\omega}{2}$, formula (3) of Chapter I gives values of δ that are equal, but with the contrary sign; and hence the same V_r corresponds thereto.

$\beta_1 - \frac{\omega}{2}$	$\frac{v''}{v}$	u
0°	1.4	0.26
30°	2.0	0.20
60°	2.4	0.16
90°	2.5	0.15

These values show that if $\beta_1 - \frac{\omega}{2}$ is included between 30° and $180° - 30° = 150°$, and if the evolution is such that it is of long duration when executed with the speed ratio $\frac{1}{2}$, the advisability of the evolution with the ratio $\frac{8}{10}$ is to be excluded, because the greater distance gained in the direction of the course appears to be a negligible advantage when compared with the increase that is realized in the duration of the evolution; in other words, the time necessary for securing the benefit represented by the difference $p'' - p'$ is so long that we cannot rely upon the tactical conditions remaining stationary long enough to permit of completing the evolution.

For example, let us suppose the speed $V = 18$ knots an hour, or 558 meters a minute; let $\beta_1 - \frac{\omega}{2} = 75°$ and $t' = 10$ minutes, as is the case with a fleet of ships in line abreast at intervals of 500 meters, that wishes to change the bearing through 30°; we have, then, $t'' = 24$ minutes (about), and $p'' - p' = 0.16 \times 558 \times 10 = 890$ meters.

If $\beta_1 - \frac{\omega}{2}$ is less than 30° or greater than 150°, the angle of change δ is greater than that which would be required, for the same value of ω, in the case before considered; that is to say, with respect to that case, and with the same method, the evolution is more rapid; and it is to be noted that t'' diminishes more rapidly than t' because, as the table shows, the ratio $\frac{t''}{t'}$ diminishes while u increases; and hence the evolution with the ratio $\frac{8}{10}$ may really be advantageous. For example, for the fleet of 12 ships before supposed, when $\beta_1 = 40°$ and $\omega = 30°$, we have $t' = 7.5$ or $t'' = 12$ minutes, and $p'' - p' = 0.22 \times 558 \times 7.5 = 940$ meters.

Now let us note that in order to have $\beta_1 - \frac{\omega}{2} < 30°$, it is necessary for β_1 to be between $\frac{\omega}{2}$ and $30° + \frac{\omega}{2}$; but since, as a measure of safety, we cannot allow the course of the pivot ship to be crossed during the evolution, β_1 must be included between ω and $30° + \frac{\omega}{2}$; or, it must be greater than $150° + \frac{\omega}{2}$.

Moreover, considering that it is necessary to avoid excessively long evolutions, it is well that the evolutions with the speed ratio

$\frac{8}{10}$ should be restricted to the case in which ω is not greater than 30°; so that such evolutions, in view of the limits of β_1 just found, may be deemed advantageous *for lines of bearing nearer to the column of vessels than to the line abreast.*

When ω does not exceed about 10°, t' is small whatever may be the value of $\beta_1 - \frac{\omega}{2}$, and hence no importance can be attributed to the difference $p'' - p'$; however, as t'' is also sufficiently small, the evolution with the ratio $\frac{8}{10}$ is justified by the possibility of obtaining the object *with the minimum alteration of course and speed.* In other words, we may in general affirm the propriety of adopting the ratio $\frac{8}{10}$ when the evolution can almost be considered as a rectification of the formation. It is clear that in such case it is not advisable to apply the rule of De Gueydon for the change of course of the pivot ship; the course of the pivot must remain unchanged.

The evolution with the ratio $\frac{1}{2}$ is then advisable when ω is of considerable amplitude, and the formation is nearer to line abreast than to column of vessels.

53. *Change of Alignment by Wheeling.*—I. Admiral Bouet de Willaumez, in his *Projet de tactique navale* (1855), in which he laid down the basis for the evolutionary systems for steam vessels, in considering the wheeling of a fleet drawn up in line abreast, alluded to the system of pivoting on the center ship, one-half of the vessels going ahead and the other half backing; naturally, he discarded the method, since evolutions cannot be performed by going astern, and he limited the practical methods to those which pivot on one of the extremities of the formation. Nevertheless, the idea of the illustrious admiral can be applied to the wheeling of a column of vessels without need of backing the engines; in such case, as indicated by the anonymous writer in the United Service Magazine already cited (section 33, III), it is possible to change the alignment by pivoting on an intermediate ship of the formation; or, the line may be considered as composed of two parts, one of which has the pivot ship for a leader, and the other has it for the rear ship; and hence the first performs the evolution by executing the wheel on the leading ship, while the other makes the change of course necessary for wheeling on the rear ship.

On the basis of the idea already advanced that, tactically, it is not important to maintain a fixed formation, we may not, in gen-

eral, assign importance to wheelings; that is to say, it is not necessary at the end of the evolution to re-establish the polar bearing that the formation had initially; however, if the wheeling of a column of vessels can be executed rapidly by pivoting on an intermediate ship, we are induced to favor this method for changing an alignment, considering the column of vessels as a transitory formation, as is done in evolutions performed in succession. In other words, being upon any line of polar bearing a, in order to change the alignment we can change the course of the ships simultaneously through the angle a, thus bringing them into column of vessels, then execute the wheel on a conveniently selected pivot ship, and afterwards, with another simultaneous change of course, take the direction that is deemed advantageous.

In such an evolution the pivot ship evidently cannot maneuver according to the rule of De Gueydon, because the two parts of the line execute changes of course in contrary directions; hence, the pivot ship must alter the course through the angle ω, through which it is desired to change the alignment, and afterwards reduce speed in the desired ratio with the evolutionary speed.

After what has been said in section 33, it is easy to determine the criterion according to which the pivot ship should be selected.

Evidently, in order to wheel a column of vessels A_1A_2 (Fig. 18), the ship B most convenient as a pivot, is the one to which there corresponds an evolution of the same duration for each of the extreme ships, A_1 and A_2, that are respectively the rear ship and the leading ship. Having demonstrated that $\frac{A_1B}{A_2B} > 1$, it quickly follows that *the point of rotation is ahead of the center of the line.*

In particular, from the table of section 33, IV, which, for the speed ratio $\frac{1}{2}$, gives the values of the ratio $\frac{t_2}{t_1}$ between the duration of a wheel on the rear ship, and that of a wheel on the leading ship (or, it gives the values of $\frac{A_1B}{A_2B}$), we may deduce the ratio $\frac{A_2B}{A_1A_2}$; that is, the distance of the pivot from the leading ship as a function of the length A_1A_2 of the line. In fact, we have

$$\frac{A_2B}{A_1A_2} = \frac{1}{1+\frac{A_1B}{A_2B}} = 1 + \frac{1}{1+\frac{t_2}{t_1}}.$$

Indicating by t_3 the duration of the wheel when pivoting on B, it is clear that $\frac{A_2B}{A_1A_2}$ is equal to the ratio $\frac{t_3}{t_2}$, the values of which, multiplied by the corresponding values of $\frac{t_2}{t_0}$ given by the table of section 33, IV (t_0 being the duration of the evolution performed in succession), give us those of the ratio $\frac{t_3}{t_0}$.

In the following table are set down the values of the two above-mentioned ratios.

ω	$\frac{t_3}{t_2}$	$\frac{t_3}{t_0}$
15°	0.46	0.15
30°	0.42	0.29
45°	0.39	0.43
60°	0.36	0.55
75°	0.33	0.65
90°	0.31	0.75

These results show: 1st. That with ω greater than 60° the pivot ship may be held to be the one at about one-third the length of the column from the leading ship; while, if ω is less, the pivot ship is the one at about four-tenths of that distance. 2d. That the method of wheeling just cited is advantageous when compared to that performed in succession, especially for values of ω less than 60°.

From what has been said, the ships astern of the pivot ship should change course as in any ordinary wheel on the leading ship; but, for a certain number z of them, the evolution may be simplified by prescribing that they follow the pivot ship in succession on the basis of the following considerations.

As the pivot ship, after having changed course through the angle ω, takes up the speed $\frac{1}{2}V_A$, a ship that occupies the position z astern of the pivot, and which follows it in succession, arrives on the new alignment after a time $z\,\frac{d}{\frac{1}{2}V_A}$; d being the distance between two adjacent ships.

To the end that the said time may not exceed that occupied by the last ship of the line in executing the wheel, it is necessary to realize

$$z\,\frac{d}{\frac{1}{2}V_A} \leq t_3.$$

Let n be the total number of ships composing the line. The time that would be occupied in following the leading ship in succession at a speed V_A is expressed by

$$t_0 = \frac{(n-1)d}{V_A};$$

and hence we must have

$$z = \frac{(n-1)}{2} \frac{t_3}{t_0},$$

in which the values of $\frac{t_3}{t_0}$ that it is necessary to introduce are those previously obtained. Under the two hypotheses of a line composed of 12 or of 8 units, the number of ships that can maneuver in succession astern of the pivot ship is given by the following table:

ω	$n=12$	$n=8$
15°	..	..
30°	1	1
45°	2	1
60°	3	1
75°	3	2
90°	4	2

So, as an illustration, with a line of 12 ships, wishing to execute a wheel of about 90°, the first four ships and the last three must perform the evolution at a speed V_A, while the five center ships must keep the speed $\frac{1}{2} V_A$.

In general, the difference of speed required for the center ship and for those at the extremities shows, as is noted by the English writer already mentioned, that this method of changing the alignment is *particularly advisable when the limited speed of the fleet is due to considerable differences in the maximum speeds of the various ships.* In fact, it has already been established that the normal speed must be $\frac{9}{10}$ of the maximum speed of the slowest unit; it has, furthermore, been affirmed that the evolutionary speed may be equal to the said maximum speed. This limit cannot be exceeded in evolutions performed in succession, and in those with oblique courses wherein one of the extremities of the formation is made the pivot, it being necessary that the angle of change of course be the same for all the ships. It is clear, however, that in order to obtain the maximum rapidity in wheeling the column of vessels by the method described, *if the divisions composed of the fastest ships are placed at the extremities,* such ships can avail

themselves, not only of the reserve of speed defined in section 49, but also that which results from the difference between the normal speed of the fleet and the maximum speed of the said divisions.

If the ratio between the maximum speed of the central division and the maximum speed of the extreme divisions does not exceed $\frac{8}{10}$, from what proceeds there results, within certain limits, *the possibility of wheeling the line without loss of speed to the fleet as a whole*, by executing the change of course ω in succession with the central division, and by the ships of the extreme divisions going to their positions with the reserve of speed. With the speed ratio $\frac{8}{10}$, this method may be held to be advisable when ω does not exceed 30°.

II. Let us suppose our fleet to be on any line of polar bearing a; let OS (Fig. 27) be the alignment, OR the course steered; and it

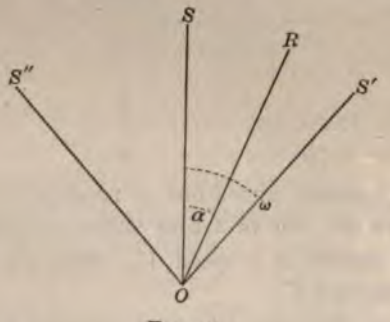

FIG. 27.

is desired to pass to the alignment OS', inclined to the present alignment at the angle ω, pivoting on one of the extreme ships. Analogously to what has previously been said, we can have recourse to the column of vessels as a transitory formation, by changing course together on the initial alignment, and then wheeling the column on the rear ship or on the leading ship, changing course in the first case through the angle ϕ_c in the direction of the new alignment, and in the second case through the angle ϕ_t in the contrary direction; ϕ_c and ϕ_t being the angles given by formula (4) and (5) of Chapter I. Let us observe, however, that the ships being, by hypothesis, already inclined by the angle a in the direction of the new alignment, the angle of change, instead of ϕ_c, is $\phi_c - a$ in the case of pivoting on the rear, and $a + \phi_t$ when pivoting on the head. Taking this into consideration, the evolution may

then be executed in the same manner indicated in Chapter I, for wheeling a column, without any complication whatever; because, according to the case, it suffices to subtract from, or add to, the angle of the change of course taken from the table for wheeling the column, the polar bearing of the formation.

It is obvious that the evolution is executed analogously if the new alignment is inclined the opposite way; thus, in Fig. 27, if the new alignment is OS'', the angle of change for wheeling on the rear ship is $\alpha+\phi_c$, and for wheeling on the leading ship it is $\alpha-\phi_l$.

Having thus generalized on the wheeling of the line, let us look into the importance to be attributed to such an evolution.

The party A (Fig. 28) has an alignment A_1A_2 in the direction of the course C_NC_N' of the enemy's center; it makes its alignment rotate through an angle ω, pivoting on the extremity A_1 farthest from the adversary. Since we leave it undetermined whether, with respect to the course of the fleet, the said extremity is farthest ahead or farthest astern, our reasoning is general and tends to establish the advisability of wheeling either on the head or on the rear.

FIG. 28.

For simplicity's sake, let us suppose that A_1 remains stationary during the wheel; the center C_A of A takes the position C_A', and the new inclination of the alignment, counting from the line joining the centers, is $A_2'C_A'C_N'$, which we will indicate by Ω. As Ω is an exterior angle of the triangle $C_A'C_N'A_1$, we have

$$\Omega=\omega+C_A'C_N'A_1\text{; and hence } \Omega>\omega.$$

The advisability of wheeling upon A_1 would hence seem to result from the fact that, while the alignment rotates through ω, it really approaches the fundamental position through an angle greater than ω; while if the wheel were made about the extremity A_2, the contrary would happen; and, finally, if the rotation were made about C_A, Ω would be equal to ω.

In practice, in wheeling the alignment the pivot A_1 would not remain stationary, and, by reason of its movement, the angle Ω might be increased or diminished according to the circumstances

of the case.* So, also, the wheel on the intermediate ship, as has been said in Part I of this section, would not be made exactly about C_A; but all this does not weaken the general reasoning which would lead us to believe it advantageous to take as a pivot the extremity of the formation farthest from the enemy.

It is now necessary to determine the value of the difference $\Omega - \omega$; this is clearly at the maximum when $\Omega = 90°$; and, $A_1 A_2''$ being the position of the alignment of the party A corresponding to such an hypothesis, from the triangle $C_A'' C_N' A_1$ we get

$$\tan \omega = \frac{r}{\frac{1}{2}S},$$

S being the length of A's alignment, and r the distance $C_A'' C_N'$, or the distance between the centers after the wheel. Supposing $r = 15{,}000$ meters, and $S = 5000$ meters, we have $\omega = 80°$ (about). Since the maximum value of the difference $\Omega - \omega$ is thus 10°, it appears to be negligible, considering the rapidity with which the alignment may be rotated by pivoting about one-third of the length of the line from its head. Also, under the hypothesis $r = 10{,}000$ meters, we have $\omega = 75°$ (about), or $\Omega - \omega = 15°$. *The importance to be attributed to the wheel when pivoting on one of the extremities is hence restricted to that which results from the study made in Chapter I,* in which it was established that, within certain limits, it may be preferred to the evolution in succession when the line is very long.

As has been said, on account of the rapidity, pivoting on the ship about one-third from the head of the line is preferable to pivoting on one of the extremities. Nevertheless, being on a line of polar bearing, the evolution just mentioned may be advisable, as it avoids the initial passage to the column of vessels. Having regard to the amplitudes of the changes of course that the method requires it is seen that *it is best to pivot on the rear ship if the course is inclined in the direction of the new alignment, and on the leading ship if the course is inclined in the opposite direction.*

54. *Angular Alignments.*—The angular orders, so much esteemed when the ram was considered the principal weapon, seem

* If A_1 were the rear ship, the angle Ω would also be increased, because the displacement of the pivot would be in the direction $A_1 A_1'$; while, if A_1 were the leading ship, the displacement of the pivot would be in the direction $A_1' A_1$; on the other hand, since we know that the evolution on the leader is more rapid than in the other case, we must conclude that we are confronted with contradictory elements. (Author's note.)

today to acquire new importance, but on a different basis, for the reasons adduced in Chapter III of Part I (sections 18 and 20). As we there pointed out, the angular alignments are advisable in offensive contact for the purpose of having each of the elementary portions of a composite alignment in fundamental tactical position.

This advisability commences in contact out of range at the moment when the limit of offensive contact is about to be crossed, with the application of the following rule, the necessity for which seems obvious.

In contact out of range the fleet must be on a single line of polar bearing; if this is such that, when it is about to arrive at firing distance, one of the elementary alignments is in fundamental position, then, with such division taken as a pivot, the other elementary alignment may be changed so as to establish offensive contact in the most advantageous manner.

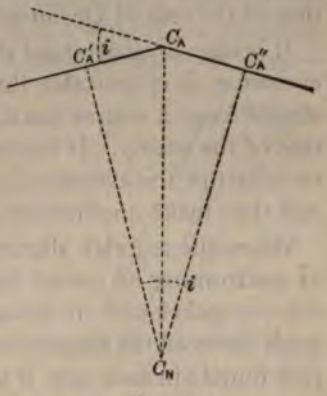

FIG. 29.

On the basis of this rule, under the hypothesis that the enemy has his forces compact, the limits within which the inclination i (Fig. 29) of the elementary alignment may vary, can be determined. Let C_A be the center of the alignment of the party A, and let C_A' and C_A'' be the centers of the elementary alignments.

Evidently the maximum value of i results under the hypothesis that the alignments must be in fundamental position with respect to one and the same elementary alignment of the enemy's formation which has its center at C_N. In such case we have

$$C_A' C_N C_A'' = i;$$

and hence

$$C_A' C_A = C_A'' C_A = C_A C_N \sin \frac{i}{2}.$$

Indicating by n the number of ships in the A party, by d the distance between adjacent ships, and by r the distance $C_A C_N$, we obtain

$$C_A' C_A = C_A'' C_A = \frac{(n-1)}{4} d;$$

therefore we have

$$\sin \frac{i}{2} = \frac{n-1}{4} \frac{d}{r}.$$

Making $n=12$, $d=500$ meters, $r=10{,}000$ meters, we get $i=16°$ (about). We may then hold $i=20°$ as the maximum value of i; hence the evolution may generally be executed by oblique courses with the speed ratio $\frac{8}{16}$. Evidently the pivot, instead of being a single ship, is composed of all the ships of the elementary alignment that it is desired to leave unchanged. The fact that the pivot is an assemblage of ships, renders inadvisable the application of the rule of De Gueydon for the double change of course.

It is easy to understand that, in order to obtain the object of the evolution, it is desirable that the ships forming part of the pivot should keep a course parallel to, and in the same direction with that of the enemy. If he makes a wide change of course, it is best to interrupt the evolution, assume the course that is deemed best, and then make another attempt.

When the angular alignment is brought about by the necessity of confronting an enemy broken up into independent groups that are not echeloned in distance—as represented in Fig. 11—the angle between the elementary alignments may be greater than that just found; in such case it is generally best to assume the angular alignment by interrupting an evolution in succession.

55. *Evolutions with a Double Alignment.*—One may be induced to perform evolutions with a double alignment (section 19), in contact out of range, by one of the following considerations:

1st. In contact out of range, as well as in offensive contact, it may be desired to keep the forces massed in that way.

2d. It is evident that one can perform evolutions more easily with a simple than with a double alignment of the same length; but it might be held that, given a certain number of ships, by placing them in double rather than in simple alignment, greater evolutionary facility might be acquired by virtue of the shortening of the line. Whenever evolutionary advantages with the double alignment present themselves, it might be employed in contact out of range, passing at the proper moment to the simple alignment in order to come into offensive contact.

A fleet in double alignment may be considered as formed by groups of four ships each in parallelogram (system of Labres*),

*See the résumé of Commandante Bonamico in *Rivista Marittima*, August-September, 1902.

or of three ships in a triangle (system of Fournier *) ; finally by groups of two ships, one in each line (twin system).

Let us consider evolutions performed by the ships in succession. The maximum simplicity and evolutionary rapidity would seem to be obtainable by causing each group of four ships to maneuver by simultaneous changes of course; in fact, small changes of the course of the naval force may be obtained by having each group make the change of course when it arrives in the wake of the preceding group. However, it is easy to see what inconveniences are encountered in so doing. Let us suppose a desire to change the alignment when the ships are on two lines of polar bearing and the lines joining the corresponding ships are normal to these lines of bearing, the distance between the lines being equal to the distances between ships, so that each group of four ships forms a square. By making all the ships of the fleet on the actual alignment change course simultaneously, we have the double column. In Fig. 30 there is represented a fleet composed of two groups that are already in that formation, and there is also shown the formation that results from a change of course in succession, following the rule above indicated. As is seen in the figure, the result is that *the ships are no longer in two lines, but in four;* and it is clear that they still remain in four lines when all the fleet executes the simultaneous change of course in order to return to the original course, or to take up a new course that is deemed advantageous.

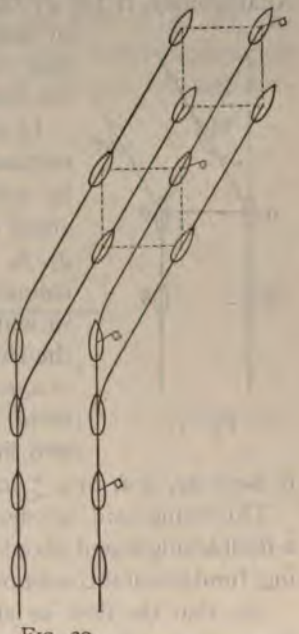

FIG. 30.

This sufficiently indicates that the method is not advisable, for the following reason:

* See *Rivista Marittima,* Vol. IV of 1907. In Fournier's system, the number of ships in one line of the alignment is half of that in the other line. With this system simultaneous changes of course are abandoned. (Author's note.)

In offensive contact, to the end that all the ships may fire, it is a necessary condition that they be not upon more than two lines. When the fleet is in two lines in contact out of range, on opening fire, it may be easy for the ships in the outer line with respect to the enemy, appropriately to modify their positions with respect to the ships in the inner line, so as to be able to fire through their intervals. This already constitutes a difficulty that, in practice, is not inconsiderable; but plainly we shall expose ourselves to the gravest risks if the matter is still further complicated by the fact that the ships are in more than two lines at such a critical moment. Analogously, if the groups of three ships each were maneuvered by simultaneous change of course, we should find ourselves forming three lines; which, for the same reasons, we believe are to be avoided.

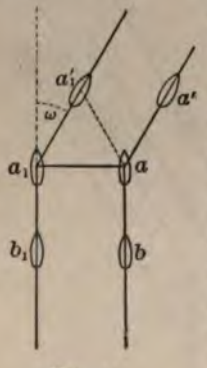

FIG. 31.

In evolutions performed in succession, the method of simultaneous changes of course may be adopted with the twin system only, for small changes of alignment. Indeed, let a, b, a_1, b_1 (Fig. 31), be four ships of the double column; when the ship b arrives in the water in which a has executed the change of course, the ship a_1 is in the position a_1' such that $a_1a_1' = a_1a = d$. To the end that, in the new alignment, the distance between the ships of the two lines may not fall below d, it is necessary to have $aa_1' \geqslant d$, or $\omega \leqq 30°$.

This being said, we deem it indispensable that the evolutions of a double alignment should be executed on the basis of the following fundamental conditions:

1st, that the fleet be always in two lines. 2d, that, in general, the corresponding ships of the two lines should have each other bearing normally to the alignment; in fact, from this position the ships of the outer line with respect to the enemy, can, at the opportune moment and with the least possible difficulty, take the necessary positions for firing; and in this way we shall avoid a long alignment.

Furthermore, we shall hold that, generally, the number of ships composing the two lines should be equal, given the essential object which we have in view which is that of shortening the line.

The fleet may be drawn up on two lines of polar bearing α; α being any angle whatever, but the same for both lines. Let us

suppose the simultaneous change of course for passing to the double column to be already executed, as in the first position of Fig. 30, and let us see how, and in what time, the change of direction of the said column can be completed, in order afterwards to take up the advantageous course by a simultaneous change of direction.

From what has been demonstrated in section 41, it results that if two ships A and B, that have respectively the speed V_A and V_B, keep each other constantly bearing abeam, the tracks described by them are concentric circumferences. Letting ρ_A and ρ_B represent the radii of the circumferences AA' and BB' (Fig. 32), described respectively by A and B when $V_A > V_B$, and indicating by d the distance between the two ships (which remains constant dur-

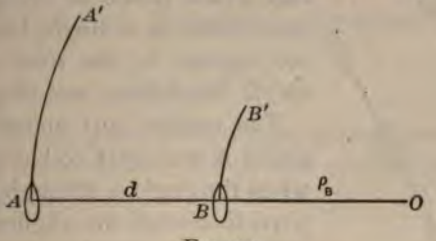

FIG. 32.

ing the movement), from formula (11) of Chapter I, substituting d for r therein, and making $\alpha=\theta=90°$, we have

$$\rho_B = \frac{d}{\frac{V_A}{V_B} - 1},$$

while

$$\rho_A = \rho_B + d = \frac{V_A}{V_B}\,\rho_B.$$

To the end that the condition $\rho_B = d$ may be realized, it is necessary to have $V_A = 2V_B$.

Now let it be noted that, between ships in formation, the tactical radius about equal to the distance d is that which is ordinarily employed when d is between 400 and 500 meters. It results, then, that, when in double column, the leading ship B of the inner line, with respect to the change of direction, puts his helm over, he must reduce his speed to one-half that of the outer line, of which the leading ship A, at evolutionary speed, must steer, keeping B, by sight vane, constantly abeam. The ships of the outer line must

keep up the speed in order to keep themselves abeam of their corresponding ships.

If n is the total number of ships in the fleet, each line is then composed of $\frac{n}{2}$ ships; and hence the time t occupied by the evolution is expressed by

$$t=\frac{\left(\frac{n}{2}-1\right)d}{V_B}=\frac{(n-2)d}{V_A}.$$

If, instead, the fleet were in single line, the time occupied would be $\frac{(n-1)d}{V_A}$; which shows that the *abovementioned method requires a time only slightly different from that which would be occupied if all the ships were in a single line, and exactly corresponds to the time occupied by a single line having one ship less.*

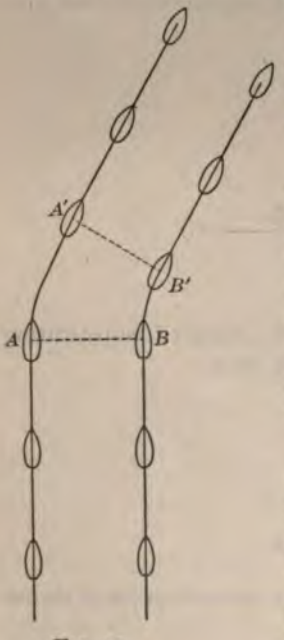

FIG. 33.

The method just indicated is general, and it is necessary to have recourse to it when the angle ω, through which it is desired to change the alignment, is of considerable amplitude; but, when ω is within certain limits, one can maneuver with greater quickness with the ratio $\frac{8}{10}$ between the speeds of the two lines, in the following manner:

The ship B, leading the inner line (Fig. 33), changes course through the angle ω in the desired direction, and assumes the proper speed for the abovementioned ratio; the leading ship A of the other line executes, with respect to B taken as a pivot, an evolution by oblique course, in order to bring itself again on the polar bearing 90°; that is to say, it completes—as is said in section 33, III—a wheel in line abreast; when A has made the wheel, that is, when it has arrived at the position A', it steers a course parallel to that of B and assumes the speed of B. The ships of each line follow their respective leaders in succession, and those of the outer line opportunely regulate their speed in order to keep themselves abeam of their corresponding ships. It is clear,

as Fig. 33 shows, that the change of direction to the new alignment will be completed when the last ship of the outer line arrives at A'; and, at the same time, the last ship of the inner line will be at B.

The duration of the evolution is hence

$$t=\frac{\left(\frac{n}{2}-1\right)d}{0.8V_A}+t_c=\frac{(n-2)d}{1.6V_A}+t_c;$$

t_c being the time necessary for the wheel of AB.

To the end that the duration of the evolution with the method may be less than that corresponding to the method by concentric circumferences before alluded to, we must have

$$\frac{(n-2)}{1.6}\frac{d}{V_A}+t_c<\frac{(n-2)d}{V_A}.$$

Making $\frac{d}{V_A}=t_0$, this inequality is transformed into another:

$$\frac{t_c}{t_0}<0.38(n-2).$$

The formula that gives the duration of the wheel of two ships in line abreast at the distance d, by virtue of what has been demonstrated in Chapter I, is

$$t_c=\frac{2d\sin\frac{\omega}{2}}{V_A\sqrt{1+\left(\frac{V_B}{V_A}\right)^2-2\frac{V_B}{V_A}\cos(\omega-\phi)}},$$

in which ϕ is the angle of change of direction for said wheel, which angle is equal to $\omega+\delta$; δ being the angle obtained from formula (3) of Chapter I, by placing in it $\beta_1=90^\circ+\omega$; in this way we get

$$\phi=\frac{\omega}{2}+\text{arc sin}\left(\frac{V_B}{V_A}\sin\frac{\omega}{2}\right),$$

wherein, in the case we are discussing, we must put $\frac{V_B}{V_A}=0.8$.

There are thus obtained the values of $\frac{t_c}{t_0}$ which are set down in the following table:

ω	$\frac{t_c}{t_0}$	n
15°	1.31	6
30°	2.59	10
45°	3.48	12
60°	4.54	14
75°	5.08	16
90°	5.87	18

With the values of $\frac{t_c}{t_0}$, taking into account the inequality above deduced, the values of n in the third column are calculated; which values indicate, for each value of ω, the minimum number of ships of which the fleet must be composed in order that the evolution performed in succession, following the wheel of the leading ships, may be advantageous with respect to the evolution by concentric circumferences.

It results from the preceding that, *in evolutions performed in succession, a fleet must be very numerous in order that it may be maneuvered on a double alignment with greater rapidity than on a single alignment.* Indeed, if the number of units is not very considerable, the angle ω must likewise be limited in order that the method by wheeling the leaders may be sensibly advantageous over that by concentric circumferences; which, in its turn, occupies a length of time not sensibly different from that required by a simple alignment. So, in order to fix the ideas, let us note that with twelve ships on a simple alignment, the evolution would require a time $11\ \frac{d}{V_\lambda}$; while with the method of concentric circumferences the time would be $10\ \frac{d}{V_\lambda}$, and, with the wheel, for $\omega=45°$, there would be a duration of $9.7\ \frac{d}{V_\lambda}$. However, the advantage of this last method is rendered sensible with smaller values of ω.

The evolution by oblique courses, in order to satisfy exactly the two conditions established as fundamental, must evidently be executed according to the following rules:

1st. Simultaneous change of course in the direction perpendicular to the alignment. The fleet is thus arranged in two lines abreast, and the corresponding ships of the two lines are in column of vessels.

2d. The ships of the first line make a wheel in line abreast of the amplitude through which it is desired to change the alignment; the ships of the second line follow in succession, opportunely regulating the speed in order to maintain the distance from the corresponding ships of the first line.

3d. The advantageous change of course is assumed with a simultaneous change of direction.

It is needless to demonstrate that this evolution is little adapted to tactical necessities.

In double column the alignment might also be changed by wheeling each of the two columns so formed; but it is to be noted that there is applicable to such a case the observation already made in this section in connection with evolutions performed in succession by means of simultaneous changes of course of the successive couples of ships; that is to say, the said wheel must be less than 30° in order that the distance between the ships of the two lines at the end of the evolution may not fall below the normal distance.

We are now able to formulate the following conclusions concerning the tactical management of a double alignment.

Having a number of ships greater than twelve, the double alignment is convenient; evolutions with it must generally be performed in succession. Evolutions by oblique courses are long and complicated; hence it is difficult to take up in that way an angular alignment, and when the latter is deemed necessary, it must be assumed by interrupting an evolution performed in succession.

With about twelve ships or less, the double alignment would allow some advantage over the simple alignment in the case of evolutions performed in succession; but it must be borne in mind: 1st, that this advantage is sensible only within very narrow limits; 2d, that with the fleet on a double alignment, evolutions by oblique courses are performed with great difficulty; 3d, that, desiring to pass to a simple alignment at the moment of coming into offensive contact, an evolution would be necessary, which, on the other hand, would not be necessary if the forces were kept on the simple alignment from the start. In short, with a not very numerous force, keeping it, in contact out of range, on a double, instead of on a simple alignment, there would be a diminution rather than an increase of the maneuvering qualities of the fleet.

Finally, as pointed out in section 19, the double alignment may be advisable for the purpose of using antiquated ships in the second line; it is clear, however, that the number of such ships must be limited, so as not in the least to encumber the maneuvering of the line composed of modern ships. The double alignment formed in this way can be maneuvered as a simple alignment when the antiquated ships are not deficient in speed, and when there is only one of them for every three or four ships of the real line of battle. The said ships of the second line, without any suggestion of exactly determined positions, will regulate themselves

in the most opportune manner in order not to embarrass the maneuvering of the principal line.

56. *General Considerations Concerning the Evolutions of Compact Forces.*—Admiral Makaroff notes how it may be well to interrupt an evolution that is in progress. "While the fleet is changing its formation," he writes, "it remains in a transitory state of maneuvering, and the admiral can undertake nothing during that time without risk of causing confusion. A case, however, may arise wherein a change of formation ought to be arrested in order that all the ships may execute a simultaneous change of course. Short signals should be employed, and we proposed that the signal 'Come along!' (Via!) be hoisted. All the ships must then, as quickly as possible, assume a course parallel to that of the admiral and thus afford him the possibility of maneuvering."

These considerations are to be borne in mind. It may be important to interrupt an evolution when a change of course is urgent, or because the new alignment signalled is no longer deemed opportune. As the ship of the commander-in-chief may not be at an extremity of the line, let us establish that, in interrupting an evolution, the ships must assume a course parallel to that of the guide ship (regolatrice).

The possibility that an evolution by oblique courses may have to be interrupted, and that for this reason a disorderly formation may result, shows us the special importance that must be attached to evolutions performed in succession; indeed, with this method, after having changed course on the initial alignment and while the ships are changing direction successively in order to arrange themselves on the new alignment, if it is discovered that the said new alignment is not satisfactory, the leading ship can change course, causing itself to be followed in succession in order to form another alignment. Hence, evolutions performed in succession do not require prevision of the tactical situation at the end of the evolution in the same degree in which such prevision is required by the method of oblique courses.

Between two fleets opposing each other which at any given instant may have alignments equally inclined to the line joining their centers, differences may be created by the following causes:

1st. *Difference of speed;* in fact, with equality and simultaneity of maneuvering, the swifter party can deploy a greater number of ships.

2d. *Difference in the length of the alignments;* when they are of the same kind (simple or double).

3d. Delay in the execution of the counter movement.

This being the case, of the two adversaries, we will say that the better maneuverer is the one that has the greater speed when the two alignments have equal lengths, or that has the shorter alignment when the speeds are equal.

It is easy to admit that, for the party that is the worse maneuverer—which we will indicate by *N*—it is well, on sighting the enemy, to assume an alignment normal to the line joining the centers (the fundamental position), while for the party *A*, the better maneuverer, it may be well to assume a different alignment.

In short, let us suppose that, in this last case, the worse maneuverer does not assume an alignment in the fundamental position, but contents himself with keeping an alignment equivalent to that of the enemy. By virtue of his better maneuvering qualities, the party *A*, on coming into offensive contact, can assume an alignment in the fundamental position with greater celerity than the enemy, or can acquire an advantageous initial position.

The interest that the better maneuvering party may have in assuming an alignment different from the normal to the line joining the centers, lies in the probability of leading the enemy into error.

Two cases, then, may present themselves to the better maneuvering party *A:* 1st, the enemy's alignment is not in the fundamental position; 2d, the enemy's alignment is in said position.

In the first case, it is well for the party *A* to assume, on sighting, an alignment equivalent to that of the enemy, changing it at an opportune moment in order to be in an advantageous position on coming into offensive contact.

In the second case, it is clear that the greater the amount of maneuvering, the more *A* can draw advantage therefrom. In other words, it is well for *A* to move toward one of the extremities of the enemy's line, obliging him to maneuver in his turn in order to keep himself in the fundamental position; in this way *A* can make an advantageous entry into the zone of fire. The counter movements of *N* will naturally be inspired by the idea of not allowing the enemy to arrive at firing distance in a superior position; and for this purpose he must have recourse to changes of bearing, keeping the enemy abaft the beam. Under such condi-

tions each of the adversaries will seek, in maneuvering, to lose the least ground possible in the direction of the advantageous course, unless they are so near to the distance for opening fire that they must seek rapidity of evolution above everything else.

On the basis of what has been said, we must hold that unless one of the parties is, to a certain extent, passive, *the phase of contact out of range will be a phase of active maneuvering*, and will produce differences in the initial conditions of position on the establishment of offensive contact. In the following chapter we shall see how this initial situation may affect the tactical maneuvering.

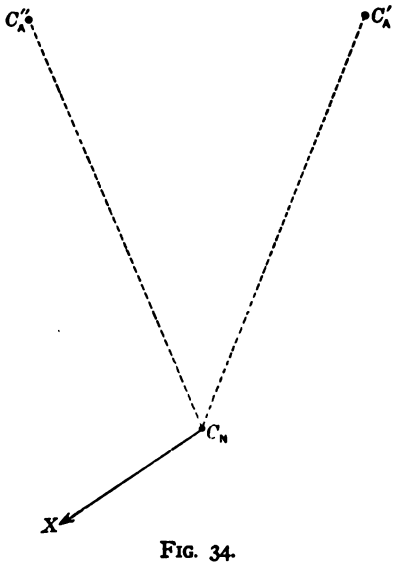

FIG. 34.

57. *Independent Groups in Contact out of Range.*—The breaking up into groups, already alluded to in section 20, appears to be opportune as regards maneuvering, for the following reasons:

1st. The duration of an evolution of a compact fleet is proportional to the length of the alignment, with equality of form of the latter.

2d. By placing the swiftest divisions at the extremities of a line, as has been said in this chapter, the utilization of their speed may be obtained, but only in some special case. In maneuvering by independent groups we may, on the other hand, tend to draw the

maximum return from the maneuvering qualities of each group, in a continuous manner, when each of them is sufficiently homogeneous as regards speed.

Let us now consider the maneuvering of a fleet formed by two independent groups, opposed to a compact fleet, in contact out of range; bearing in mind that we have already recognized the necessity, in offensive contact, of avoiding the echeloning of groups in distance.

The speed of a fleet being determined by that of its slowest unit, it is necessary to distinguish two cases:

I. Each of the independent groups has a speed superior, or at least equal, to that of the party that remains compact.

II. One of the independent groups has a speed inferior to that of the enemy's fleet.

Under the first hypothesis, if the forces that maneuver by groups sufficiently understand each other, so that, although independent, they may rely upon maneuvering in a co-ordinate way, from the maneuvering by groups the abovementioned advantages may really be hoped for, although the enemy maneuvers well. A group will maneuver so as to be at the same distance from the enemy's center as the regulating group, keeping the most opportune alignment according to the rules already established. Although, with regard to the momentary positions, an inferiority of conditions for the compact fleet does not exist—as we have pointed out already—still we must hold that it may result in practice, because the compact fleet is the poorer maneuverer.

In the second case, in order to discover the dangers of breaking up into groups, it is necessary to suppose that the enemy maneuvers in the way that is best for him. Let C_N, C_A' and C_A'' be respectively the positions of the centers of the party N that remains compact, and of the groups A' and A'' into which the party A is divided. The speed V_N of the party N is greater than the speed V_A' of the group A'. From what was demonstrated in Chapter I, it readily results that if N follows a course $C_N X$, such that the polar bearing XC_NC_A' is equal to or greater than $90° + \text{arc sin } \frac{V_A'}{V_N}$, the distance C_NC_A' continually increases, whatever may be the course of A', because this is the case in which for the slower party, the problem of approach admits of no solution.

This said, it is clear that the course of N may be such as to avoid the approach of A',* producing at the same time the removal of N toward A''.

Under such conditions, if offensive contact is brought about, it will be between the compact party and one of the groups of the other combatant; and in order properly to understand why, in such case, A has not the advantage in maneuvering power alluded to in the hypothesis previously discussed, it is well to reflect that, if the course of A'' is favorable to the approach, the party N, given its presumable superiority with respect to such group, has to trouble itself about the alignment in a much smaller degree than would be required against an adversary of superior or equal strength.

These considerations suffice for concluding:

1st. The necessary condition for breaking into independent groups is that each group shall have a speed not inferior to that of the enemy's fleet.

2d. When the enemy is broken up into independent groups, and one of his groups has a speed inferior to that of our total force, the conduct of our force must be conformed to the rule of moving in the direction of the swifter group, thus avoiding the nearer approach of the slower group.

* The course of N must naturally be established, taking into account the length of the formation; that is to say, it must be the most opportune for the ship that could most easily be approached by A'. (Author's note.)

CHAPTER IV.

TACTICAL MANEUVERS.

58. *Maneuvers in Column of Vessels.*—As has been pointed out in section 48, the fundamental conditions which the tactical maneuvers ought to satisfy are the following: 1st, not to disturb the firing; 2d, allow the immediate and continuous adaptation of the proper maneuver to that of the enemy, each ship imitating the movements of the guide ship as a directive.

It is clear that the simplest tactical maneuver that has the requisites enumerated, and which permits of keeping the fleet perfectly ordered, is the one performed in succession in column of vessels.

For these reasons the importance that is generally attributed to the column of vessels is justified. It is well to note, however, that, conformably to the idea several times repeated, a line of conduct contrary to the spirit of modern tactics and binding one to a fixed formation could be followed; and so, when there is a question of the column of vessels, it is generally to be understood that we do not refer to the ships in that formation keeping the course constant for long intervals, but it is implicitly the idea that the course of the leading ship is generally changeable in a slow but continuous manner, conformably to the standards established for an isolated ship; *hence we refer to maneuvering in column of vessels rather than to the formation of that name.*

Such maneuvering appears the more worthy of consideration inasmuch as the adversaries in the recent Russo-Japanese War confined themselves to it; its importance is incontrovertible, owing to the fact that it requires the minimum amount of preparation on the part of the commander; so that it is indispensable to adopt it when one has at his disposal forces that have had but little drill; but outside of this case, it is well to put the prejudicial question, asking ourselves if the said form of maneuvering is always advisable, so that, admitting its simplicity, we may excuse ourselves from studying other forms.

Against an enemy in column of vessels, the criteria established in section 15 for the selection of ships upon which to concentrate the fire, must be supplemented by taking also into account, besides the firing distance, the disorder that is produced in the enemy's

formation by obliging one ship to fall out of the line rather than another. The advisability of each elementary alignment concentrating its offense on the leading ship of the corresponding division of the enemy rather than on the rear ship is evident, unless, in firing on the rear ship, it is possible to carry on the firing at shorter distances. It is apparent, then, that, *as between two adversaries in column of vessels with courses parallel and in the same direction, the advantageous position must be held to be the one farther advanced in the direction of the course.*

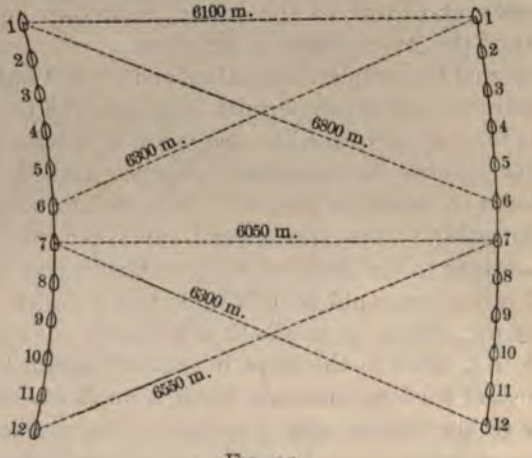

FIG. 35.

Let us consider the hypothesis that the fleets opposing each other, both in column of vessels, have, in offensive contact, alignments in the fundamental tactical position. From what has just been said in regard to concentration, if neither of the adversaries desires to change the distance, they will maneuver in such fashion that their respective center ships may have courses perpendicular to the line joining the centers, and that each may steer in the direction toward which the enemy is moving. Having alignments of the same length, in order to apply this criterion the two adversaries move initially with courses parallel and in the same direction, and the corresponding ships of the two lines will have each other mutually bearing abeam.

If a difference of speed exists between the two adversaries, the swifter party will gain in the direction of the course, thus tending to acquire an advantageous position.

It is evident that each of the two adversaries will seek to maneuver in order to keep itself in the fundamental position. Fig. 35 shows such an object attained; the centers of the alignments have each other constantly bearing abeam. The alignments are, as we already know, concentric circumferences; the ratio of their radii is equal to the ratio of their speed, and the radius of the inner circumference is expressed by $\frac{r}{\frac{V_A}{V_B} - 1}$, r being the distance between the centers, V_A and V_B the respective speeds ($V_A > V_B$).

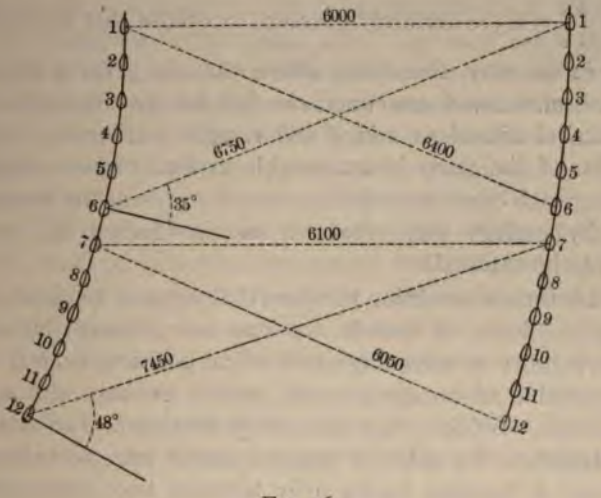

FIG. 36.

The figure corresponds to the hypothesis $r = 6000$ meters, $\frac{V_A}{V_B} = 1.5$ for the usual interval of 500 meters between ships. As shown by this, the situations of the two adversaries may be considered as equivalent; so much the more so if the speed ratio is inferior to the one supposed.

A situation nearly like the one indicated, and which is often discussed by the students of tactics, is realized when the two leading vessels, steering by sight vane, mutually keep each other bearing abeam; the radii of the circumferences are still those abovementioned, with the difference, however, that in this case r is the distance between the leading ships.

There is thus produced the tactical situation of Fig. 36, which must be held to be advantageous for the swifter fleet for the following reasons: 1st, the center of such fleet is removed forward of the beam of the enemy's center; 2d, the alignment of the said fleet is concave, while that of the other is convex, which causes it to befall that some ship does not present a sector of maximum offense. Such advantages increase with the diminution of the distance and with the increase of the ratio $\frac{V_A}{V_B}$.

With the supposed data, as the firing distances marked in the figure show, the swifter fleet has a sensible advantage; but the value $\frac{V_A}{V_B} = 1.5$ is certainly greater than those that are realized in practice; we may, therefore, affirm that, *in general, by making the abovementioned maneuver, the two adversaries are in equivalent tactical situations which will remain stationary.* Since the situation of the fleets is comparable to that of two single ships opposing each other and which constantly present the beam to each other, by analogy with what we said in Chapter II, we cannot hold it to be rational.

We are thus in condition to affirm that, against an enemy maneuvering in column of vessels, we may not presume, by imitating him, to acquire an advantageous tactical position, even if we possess a notable advantage in speed, *unless we have also a notably shorter line.* Indeed, Figs. 35 and 36 show how two adversaries that present to fire sides of opposite names may be in equivalent positions; it happens analogously between two adversaries who are in fundamental position in column of vessels, with courses parallel but in opposite directions, each of whom changes direction in succession with intent to assume an advantageous position. In this case the alignment of the slower party also turns its concave side to the enemy.

It is readily seen that, for changing the distance, maneuvering in column of vessels is hardly advisable. For such purpose, let us consider the ships of an elementary alignment that concentrate their fire on one of the enemy's ships. In order that the concentration may be possible, it is necessary for the ship nearest the said enemy's ship to have it bearing in a direction near the beam; sufficiently near, at least, to allow the most distant ship to fire in a limit direction of a sector of maximum offense.

Let us refer to what we noted in section 37 concerning the radii of curvature.

If the two adversaries expose to fire sides of opposite names, the radius of curvature of the track described by the party that maneuvers in column of vessels is necessarily very great, and hence the track may practically be considered rectilinear for a segment of a length equal to that of an elementary alignment.

This being the case, solving the triangle formed by the alignment and the two lines joining its extremities with the said enemy's ship, it is perceived that if, for example, the sectors of maximum offense extend to 45° from the beam; the nearest ship must hold the said enemy's ship by sight vane in a direction at least 60° from the longitudinal axis. In such case, *the ships maneuvering in succession in column of vessels are in the condition of a single ship whose sectors of maximum offense do not extend farther than 30° from the beam;* or, maneuvering in succession, one may not generally rely upon controlling the development of the action.

When the two adversaries present to fire sides of the same name, the radii of curvature are greatly reduced; but, even if the concavity of the alignment toward the enemy is sufficient to annul the abovementioned inconvenience, *it does not do away with the fact that the alignment of the party that maneuvers in succession is inclined to the line joining the centers;* while, if the enemy's alignment is in fundamental position, it is obvious that he can oppose changing the distance by opportunely inclining his ships on the alignment.*

* Whoever wishes to study the question in a theoretically more exact way may profit by the knowledge of the following theorem: If two ships steer keeping themselves on constant polar bearings, not only is the indicator of relative movement an equiangular spiral, as we have already had occasion to mention (see note to section 36), but the tracks actually followed by the two ships are also equiangular spirals which are inclined at the same angle with the radius vectors leading from the pole which is common to both. The angle of inclination of the spirals, adopting the usual symbols, is given by the formula

$$\tan i = \frac{V_B \sin \theta - V_A \sin \alpha}{V_B \cos \theta - V_A \cos \alpha}.$$

It results from this that, if one of the two ships is followed by others in succession, the alignment is on an arc of an equiangular spiral.

Lieutenant L. Tonta has occupied himself with this theorem in a valuable article in the *Rivista Marittima* of March, 1901. The question has

Hence, maneuvering in succession may lead to a disadvantageous situation; it lessens the capacity for tactical initiative, because in adopting it *we are obliged to change the alignment, when all that is necessary is a change of course.*

Evidently, the inconveniences of the column of vessels are increased with a composite alignment; that is to say, the greater the number of ships that follow the leading ship.

The advisability of having the ships inclined to the alignment has been alluded to. In general, the idea of keeping the alignment constant for considerably long intervals of time, changing the inclination of the ships to it according to need by means of simultaneous changes of course, does not seem acceptable, because this may permit an adversary who maneuvers in column of vessels to take advantageous positions; this means, opposing a rigid alignment to another eminently flexible; and, for simultaneous changes of course, signals are rendered necessary.

It would, therefore, seem advisable to establish maneuvering in column of vessels as normal, yet not excluding fighting on lines of bearing because of the simultaneous changes of course that may eventually be required; but the defects which we have recognized as attributable to maneuvering in column of vessels lead us to seek a better system.

Maneuvering by simultaneous changes of course presents the aforesaid inconveniences when the changes are intermittent; but we have already alluded (section 17) to a form of alignment (at equidistant positions) which appears susceptible of being maintained in fundamental position; let us seek to develop this idea by procuring the elimination of the inconveniences of maneuvering in column of vessels without falling into that of rigidity of alignment.

We propose to see whether it is allowable to hold as normal the maneuver known as keeping the alignment at equidistant positions, having recourse to the column of vessels as a transitory formation for the evolutions.

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been discussed in France in divers articles published in the years 1875, 1876 and 1880 in the *Revue Maritime;* the results of these studies are set forth in Chapter II of *Manuel pratique de Cinematique navale* by Comdr. L. Vidal (1905). In practice, however, for the length of the alignment, the equiangular spiral may be considered as an arc of a circle the radius of which is given by formula (11) of Chapter I. (Author's note.)

Such importance as a transitory formation may be admitted without further argument, observing that, if it is necessary notably to change the alignment, the evolution must be such as not to render perilous the effects of an erroneous prevision of the tactical situation at its end; or, at such a moment, it is best to be in column of vessels. *The evolutions that we must examine for the change of alignment in offensive contact are thus reduced to that performed in succession and those based upon wheeling the column of vessels* (section 53).

59. *Maneuvering at Equidistant Position.*—By virtue of what we said in section 17, an elementary alignment opposed to another may practically be considered an arc of a circle having its center at the center of the enemy's alignment, when, an extreme ship

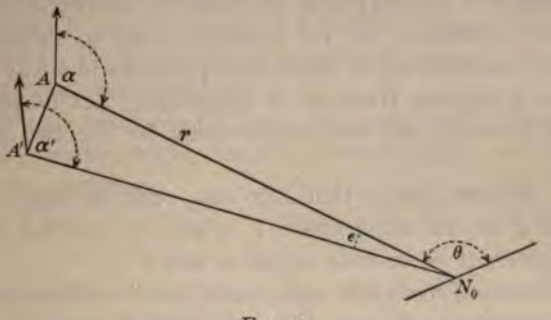


FIG. 37.

being taken as the regulator, every ship is in a position such that the angle between the line joining it with the adjacent ship in the direction of the regulator and the line joining it with the aforesaid enemy's center, is 90°.

Supposing the ships to be on such an alignment, we propose to study the maneuvering that permits of maintaining it.

Let us consider two adjacent ships A and A' (Fig. 37) of an alignment at positions equidistant from N_0, having as a radius the distance r; the angle $AA'N_0$ being 90°. Let us indicate by d the distance AA' and by ϵ the angle AN_0A'; we then have

$$\sin \epsilon = \frac{d}{r}.$$

Let α and α' be the polar bearings on which, at the instant under consideration, the respective ships A and A' hold N_0; these bearings being counted from the bow. If θ is the polar bearing on

which A is held by N_0 (counted from the stern), the analogous bearing for A' could be $\theta+\epsilon$ or $\theta-\epsilon$. We will indicate by V, V' and V_N the respective speeds of A, A' and N_0.

Let us note first of all that if there exists the relations

$$V \sin \alpha = V_N \sin \theta,$$

the indicator of movement of A with respect to N_0 is given by the joining line AN_0; and hence, in order to preserve the alignment in the fundamental position, the ship A' (and, more in general, the ships of the alignment opposed to N_0) must keep the course and speed of A.

While not excluding the possibility that the conditions just mentioned may be realized in practice, it is readily seen that this method *with uniform speed and course* cannot be held to be general, because it is not logical to establish the aforesaid relation as a necessary condition; let us, however, seek to determine the criteria for maneuvering at equidistant positions in a way that may permit the maximum freedom of execution. Let us see if it is acceptable to carry out the maneuvering by the two following methods:

1st. *At uniform speed;* that is to say, with the ships A and A' maneuvering at the same speed V which, in general, naturally requires different sight-vane angles α and α'.

2d. *With a uniform sight-vane angle,* which ordinarily requires that the ships A and A' have different speeds V and V'.

In both cases the ships of the A party must move in such a way that, in the time dt, they may have the same change dr in the distance from N_0. If we wished to calculate the unknown values α' and V' it would then suffice to apply the fundamental tactical relation. Thus, for the method at a uniform speed, we have

$$V_N \cos \theta - V \cos \alpha = V_N \cos(\theta \pm \epsilon) - V \cos \alpha'. \qquad (1)$$

Naturally, when the value of $\cos \alpha'$ supplied by this formula is not, in absolute value, less than unity, it means that the method is not applicable.

For the other method, in the foregoing relation it would be necessary to put $V' \cos \alpha$ in place of $V \cos \alpha'$; in other words, we may say that the value of V' must satisfy the condition

$$V' \cos \alpha = V \cos \alpha', \qquad (2)$$

wherein it is necessary to introduce the value of $\cos \alpha'$ obtained from (1).

Applying these methods, evidently the distance AA' does not remain invariable.

In order to fix these ideas, let us consider the simplest hypothesis, which is that of a stationary enemy. Putting, in formula (1), $V_N=0$, we have $a'=a$; which, introduced into formula (2), gives $V'=V$; hence, in the particular case to which we now refer, the two methods just mentioned are combined, the ships being able to maneuver with uniform speed and sight-vane angle. Against a low fort, or a ship at anchor, such maneuvering may be opportune, because it permits the ships of a homogeneous division to keep the enemy bearing in a direction of maximum utilization.

We may, then, in a very simple way, extend the rules established for maneuvering an isolated ship to the maneuvering of a division; because such rules, in the case of a stationary enemy, evidently lead to maneuvering at a limited distance, keeping the enemy bearing in directions of maximum utilization alternately forward of and abaft the beam.

In such case the joining lines AN_0 and $A'N_0$ both revolve through the same angle, because formula (10) of Chapter I (section 37), becomes

$$\frac{d\sigma}{dt}=\frac{V\sin a}{r}.$$

The angle ϵ under which the ships A and A' are seen from N_0 thus remains invariable; therefore, when the radius of the equidistant alignment passes from a value r_1 to a value r_2, the distance AA' changes from a value d_1 to d_2; and there is realized

$$\frac{d_1}{r_1}=\frac{d_2}{r_2};$$

both the members of the equation being equal to sin ϵ. Consequently, if r_1 and r_2 are respectively the superior and inferior limits between which it is predetermined to maintain the distance from the enemy N_0, when the maneuvering is begun at the superior limit of the fighting distance it is necessary that the distance d_1 between ships be established as somewhat greater than the allowable minimum, remembering that during the maneuvering it will be reduced to d_2. When, as generally happens, the ratio $\frac{r_2}{r_1}$ is not inferior to $\frac{7}{10}$, it might seem opportune to establish for d_1 the value that is ordinarily assumed as the normal; and this in conformity with what is said in the preceding chapter concerning

the diminution of the distance allowable during the evolutions. It is clear, however, that in every tactical maneuver this tolerance may obtain within narrower limits; thus, in the special case that we are considering, it is necessary to remember that, at the instant at which the ships find themselves at the minimum distance, they must execute a simultaneous change of course in order to bring the enemy to bear abaft the beam; it is, therefore, well to establish that the normal distance between ships shall be realized for the mean distance $\frac{r_1+r_2}{2}$ from the enemy, rather than for the maximum distance r_1.

For example, supposing the limits between which it is desired to keep the firing distance to be 10,000 meters and 7000 meters, and the normal distance between ships to be 500 meters; to the end that the latter may correspond to the mean distance (8500 meters) from the enemy, it is necessary for the ships, when they begin the action at the distance of 10,000 meters, to have an interval between them of 600 meters; and, by reason of the maneuvering, at the limit of the approach it will be 400 meters; which will always be sufficient.

Such an amount of oscillation (100 meters more or less than the normal distance) is allowable even against an enemy's fleet in motion; and in fact it is well to observe: 1st. That, theoretically, every increase in length of the alignment constitutes a disadvantage of position; however, as we have already observed in Chapter III of Part I, if the difference in length between two opposing alignments is 500 or 1000 meters, it may be held to be negligible in practice, because only a small part of it affects the conditions of position. 2d. The normal distance between ships must of necessity be established as somewhat greater than the minimum which confers safety of maneuvering.

Without doubt, then, we may affirm that, having regard to maneuvering at equidistant positions in the general case of an adversary in motion, it is well to be governed by the following rules: 1st, watch the variations of the distance between ships, with the understanding that these variations are to be kept within sufficiently narrow limits; 2d, it is well that the distance between ships at the limit of offensive contact should be somewhat greater than the normal.

This being established, we make the following reflections:

The method at uniform speed is naturally that which at first sight appears to be preferable; but it may possibly lead to varying the distance between ships beyond the desired limits. On the other hand, the method with a uniform sight-vane angle might require a ratio $\frac{V'}{V}$ differing too much from unity.

Let us note that, for the maneuver in question, the ship A', in order to keep the speed V, should keep N_0 bearing at an angle α', while the polar bearing α would correspond to the speed V'; hence, to a bearing α_1 intermediate between α and α', there will correspond a speed V_1, intermediate between V and V'; or, the ratio $\frac{V_1}{V}$ will be nearer to unity than $\frac{V'}{V}$.

We recall further that, while the ship N_0—from which it is desired to keep the ships of the alignment at equidistant positions—is the one that occupies a central position in the enemy's alignment, the ship upon which ordinarily it is best to concentrate the offense, is an extreme ship of the said alignment. It results from this that the extreme ship of our own alignment, which serves as a regulator, must keep the enemy's ship for the concentration of fire at an opportune sight-vane angle which will be established according to criteria of which we will shortly speak; the polar bearing of N_0 will be the one which will derive as a consequence of this. If, thus far, we have referred to the polar bearing of N_0, it has only been for the sake of simplicity of reasoning.

The criteria sought for the execution if the maneuvering at equidistant positions may be established in the following manner.

Let us suppose our alignment to be in the fundamental position, and that the ships have all the same course, so that they are on a line of polar bearing. An extreme ship, taken as a regulator, keeps the enemy's ship for the concentration of fire on an opportune bearing, and, more in general, maneuvers, with respect to the said enemy's ship, in a way conformable to the criteria determined upon in the study of the naval duel; thus describing, generally, a curvilinear track with a great radius of curvature.

Each ship continually imitates the movements of the adjacent ship in the direction of the regulator in such fashion as to keep itself in the position from which may result the angle of 90° between the line joining it with the said adjacent ship and the one joining it with the center of the enemy's alignment. With such

object it may slightly modify its course with respect to the adjacent ship, but within a limit that does not produce too notable variations of distance. Such limit being reached, it is best for the said ship to vary the speed in order to preserve the desired position.

Briefly, it may be said that *a ship must imitate the movements of the adjacent ship; that is, keep on a course about parallel to it, slightly modifying its course and speed in order to satisfy the 90° rule.*

Thus *the way to carry out the maneuvering at equidistant positions is by the fusion of the methods before alluded to.* It is evidently well to ordain that the regulating ship be the inner one on the side of the changes of course necessary for steering by sight vane, and it is generally advisable for the said ship to maintain a speed slightly inferior to the normal speed,* to the end that the maneuvering may be facilitated for the other ships; or, in order to increase their reserve of speed. It is possible that the reserve of speed of the other ships may not be sufficient for maintaining the alignment in fundamental position; nevertheless, it is easy to see that the most rational criterion for maneuvering remains as abovementioned; indeed, in such case, although not fully attaining the object of keeping the alignment in fundamental position, we approximate to it as nearly as possible.

If the regulator ship develops the maximum speed, the application of the prescribed rule causes the ships to change course in a continuous way parallel to it; *and the formation becomes a line of polar bearing, in which, however, the bearing may be slowly variable,* the ships executing continuous but very slow changes of course with a great radius.

*As has been said in the preceding chapter (section 49), the normal speed is inferior to the evolutionary speed which is generally the maximum speed of the slowest unit. When the alignment is changed by wheeling the column of vessels, it is necessary for the pivot ship to reduce its speed to one-half of the evolutionary speed; but, in the case of maneuvering at equidistant positions, the reduction of the speed of the regulator ship must be kept within restricted limits, enabling the speed to be maintained. In like manner to that of limiting the reductions from the maximum to a speed inferior by four or five knots—established for the naval duel—it is well to ordain that the speed of the regulator ship in the maneuvering under consideration shall not fall more than three knots below the normal speed. (Author's note.)

Let us now consider a composite rectilinear alignment; that is to say, two contiguous elementary alignments placed one on the prolongation of the other, or an angular alignment. It is clear that, in each elementary alignment, it must be sought to maneuver at positions equidistant from the enemy's corresponding alignment. One of the elementary alignments acts as a regulator; and the extreme ship of the other alignment, adjacent to the outer ship—with respect to the change of course—of the regulator alignment, imitates the movements of the latter, modifying its speed in the manner most opportune for the object that it is desired to secure.

From the foregoing we may conclude:

1st. The tactical maneuvering to be held as normal is that at equidistant positions; there results from it a flexible alignment, capable of being adapted in a continuous manner to the changeableness of the tactical situation, without disturbance to the firing.

2d. The said maneuvering admits, as a particular case, having a *constant alignment,* in which an extreme ship steers with the sight vane on an enemy's ship, and the others imitate its movements, tending to keep the courses parallel.

3d. The type of maneuvering just indicated presents no dangers, the inner ship on the side of the changes of course being chosen as the regulator, and the said changes being with a great radius resulting from steering by sight vane.

60. *Inclination of the Ships to the Alignment.*—Let us now see what conditions must be satisfied by the inclination of the ships to the alignment, to the end that it may be possible to concentrate the fire, while presenting the ships in the most opportune manner as regards offensive as well as defensive conditions.

Let N_1 (Fig. 38) be the enemy's ship on which it is desired to concentrate the fire, and A_1A_2 an elementary alignment at positions equidistant from the center N_0 of the enemy's alignment which, in the figure, is supposed to be in the fundamental position; but which, naturally, could also be inclined with respect to the line joining the centers.

For the determination with which we are now occupying ourselves we may hold that the various ships of A_1A_2 have about the same course. The ship A_1, which is at the extremity of the alignment nearest to N_1, desires to bring that ship to bear in a limit direction of a sector of maximum offense; it might do this by hav-

ing its longitudinal axis * in the direction XX' or in the direction YY'; XX' and YY' being symmetrical with respect to N_1A_1.

It is clear, however, that, in the case of YY', the other ships of the alignment would have N_1 bearing in a sector of minimum offense; while if the longitudinal axis of A_1 is in the direction XX', the other ships can have N_1 bearing in a direction inside of a sector of maximum offense. Naturally the bows of the party A must be in the direction A_1X, or in the direction A_1X', according as A desires to bring the enemy to bear abaft or forward of the beam; hence it is well to reflect that, considering the sea plane to be divided into two parts by the alignment, *the bow must be toward the side away from the enemy when he is to be brought to bear abaft the beam, and toward the side next to the enemy if he is to be brought to bear forward of the beam.*

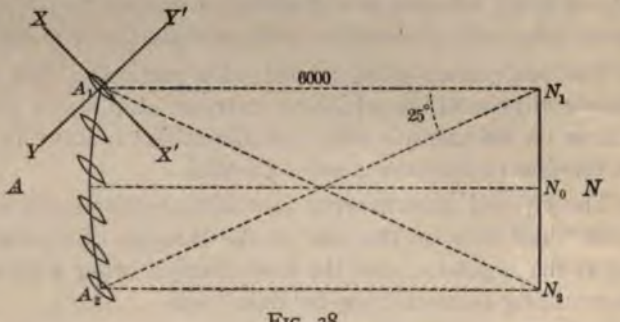


FIG. 38.

Let us now consider what may be the situation of the party A from a defensive point of view. In order to fix the idea, let us suppose that the party N is also in the fundamental position, but in column of vessels; and that the distance is 6000 meters.

The A party will possibly concentrate the fire on N_1 or on N_2; and if, as is customary, we refer to an alignment of six ships at intervals of 500 meters, the ship for concentration will receive the offense in a sector of about 25° *couting from the beam.*

This being the case, let us suppose that the ships of the A party have sectors of maximum offense with amplitudes of 45° forward of and abaft the beam; if N concentrates his fire upon A_1, that ship will receive the offense in a sector included between directions

* In referring to the longitudinal axis we consider indifferently the hypothesis that N_1 is kept forward of the beam, or that it is kept bearing abaft the beam. (Author's note.)

that form angles of from 20° to 45° *with the longitudinal axis;* if, however, the fire is concentrated upon A_2, that ship receives the offense between directions that form angles of from 20° to 45° *with the beam.* This example suffices to show that it may be advantageous to present the ships inclined to the alignment; the more so as, within the limits of distance at which it is specially advisable to concentrate the fire (section 14), the angle $A_1N_1A_2$ will have a value smaller than the one under consideration.

In case of the distribution of the fire it is seen a fortiori *that it may be advantageous to present the ships inclined so that each ship may have its corresponding adversary bearing in a direction of maximum utilization.*

It is to be noted that, when the A ships have sectors of maximum offense that extend 60° forward of and abaft the beam, if the regulator ship has N_1 bearing in a limit direction of a sector of maximum offense—that is to say, only 30° from the longitudinal axis—it is possible that some ships will be exposed to enfilading fire; which presents no disadvantages at the maximum firing distances (as is said in Chapter I, Part I), but is ordinarily to be avoided. Hence it may generally be established that *the polar bearing on which the regulator ship keeps the nearest enemy's ship by sight vane, must bear some relation to the way in which the enemy's alignment is inclined to the line joining the centers, as well as some relation to the criteria concerning the direction of maximum utilization.*

61. *Evolutions in Simple Alignment.*—For offensive contact we have established the necessity of having as little recourse as possible to evolutions; without, however, excluding the possibility of being obliged to do so in case one cannot succeed in keeping the alignment in a position sufficiently near the fundamental position.

As has already been noted (section 58), the proper methods for changing the alignment are limited to that performed in succession and those based upon wheeling the column of vessels. *In general, it is well to give the preference to the first method on account of its greater simplicity, and, owing to the possibility of changing an evolution in progress, adapting it to the counter movement of the enemy.* It results from this that the other methods abovementioned can usefully be employed in particular cases, when it may be expected to secure with them the desired objects in a considerably shorter time than would be required by

the evolution performed in succession; and this without too greatly disturbing the firing.

In executing the wheel with the speed ratio $\frac{1}{2}$ conformably to the conclusions of section 33, IV, in order to have an advantage in rapidity over the evolution performed in succession, the angle ω, through which it is desired to change the alignment, must be less than 30°, or than 60° according as the pivot is the rear ship or the leading ship. When pivoting on the ship about one-third from the head of the column—as results from the table in section 53—there is also an advantage in rapidity when ω reaches 90°.

From what has been said in this chapter, the ships will generally be inclined to the alignment. The evolution of section 53, II (which can be executed by pivoting on the rear ship or on the leading ship) permits of forming a column of vessels inclined at the angle ω to the actual alignment, without need of changing course together on the said actual alignment in order afterward to execute the wheel.

If the angle ω is within the limits above recorded, *and if the course is sufficiently near the one required for the evolution, within a limit such as to permit one to expect but little disturbance to the firing,* the evolution, pivoting on the rear ship, is advisable if the course inclines toward the new alignment, or on the leading ship if the course inclines in the opposite direction. In other words, if α is the polar bearing of the formation, it is necessary that the difference $\phi_c - \alpha$, or the other difference $\alpha - \phi_t$, be sufficiently small; ϕ_c and ϕ_t indicating, as usual, the angles corresponding to ω given in the table for wheeling the column.

When the circumstances just mentioned are not realized, the course may be changed on the alignment, thus resulting in a column of vessels, and the wheel executed afterwards, pivoting at about one-third from the head of the column; in this way a gain in rapidity may be had, but the situation will often counsel its abandonment because the said advantage will be negligible when compared to the inconvenience resulting therefrom. The English writer several times cited expresses himself in this connection in the following manner: "Wheeling a column of vessels is undoubtedly an efficacious method of changing the direction of a long line in the quickest way possible; but reflecting upon the disorganization that such a change brings upon the firing of a squadron, it must be used with extreme caution."

Moreover, in prescribing the angle through which the alignment

is to be changed by wheeling, it is necessary to keep in mind the probable counter-movement of the enemy; not taking this into account, there might be attributed to the methods by wheeling a greater importance than they really have; while, in practice, such importance is very limited.

We propose to fix these ideas by considering how such illusions may arise.

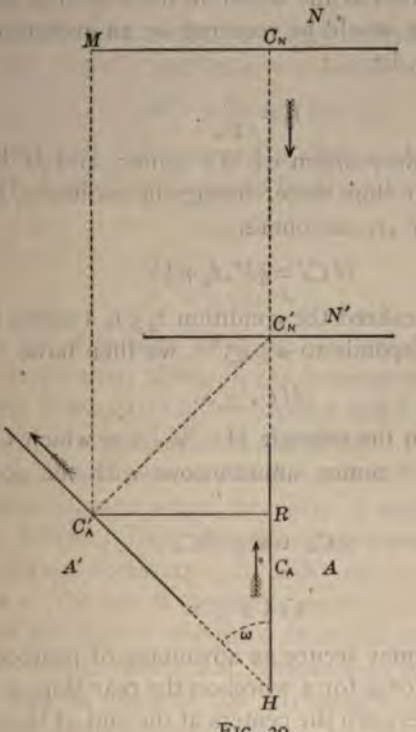


FIG. 39.

Let us suppose that the fleet A (Fig. 39) finds itself in the worst possible position; that is, the enemy N has succeeded in crossing the T, and that he has taken a course parallel and opposite to that of A with the object of maintaining his advantage of position and drawing the maximum profit therefrom by diminishing the distance. Let us indicate the speed of the A party by V_A. If this party wheels his alignment through ω, pivoting on the rear vessel, the new inclination Ω of A's alignment to the line joining the centers is greater than ω. We have already called attention to

this in section 53 and observed that in contact out of range the difference $\delta - \omega$ is of small importance; but it is understood that if the distance diminishes beyond a certain limit, the angle δ may become about 90°, ω still being within the limits before mentioned. Let us seek the conditions of distance necessary in order that we may have $\delta = 90°$.

Let S be the length of A's alignment, and let us, as usual, indicate by t, the duration of the wheel on the rear ship, and by t_0 the length of time that would be required by an evolution in succession; that is to say, let

$$t_0 = \frac{S}{V_A}.$$

If C_A' is the new position of A's center, and H is the initial position of the rear ship, since, during the evolution, the track of the pivot ship is $\frac{1}{2}V_A t_2$, we obtain

$$HC_A' = \tfrac{1}{2}V_A t_2 + \tfrac{1}{2}S.$$

When there is realized the condition $t_2 \leqq t_0$ (which by the table in section 33 corresponds to $\omega \leqq 45°$), we then have

$$HC_A' \leqq S.$$

When $\omega \leqq 45°$, in the triangle $HC_A'C_N'$ (in which C_N' indicates the position of N's center simultaneous with the position C_A'), we have

$$C_A'\,C_N' \leqq HC_A',$$

or

$$C_A'C_N' \leqq S.$$

In order that A may secure an advantage of position within the limits established for ω for a wheel on the rear ship, it is necessary that the distance between the centers at the end of the evolution be less than the length of the alignment; *and that the course of the party N be kept unchanged.*

Given that the distance is within such limits as not to exclude the possibility that A may attain his object, if the party N answers by making a simultaneous change of course so as to move in the same direction in which A executes the wheel, thus bringing itself into column of vessels, the party A, at the end of the evolution, will find itself in a situation very different from the one imagined. In fact, setting aside for both the adversaries the time required for the changes of direction, let us suppose that N's change of direc-

tion is made at the same instant at which A begins the wheel; the party N, at the end of the time t_2, would again be in fundamental position when its center should arrive at a point M, such that $C_N M C_A' = 90°$. Now, drawing $C_A' R$ parallel to $C_N M$, from the right-angled triangle $C_A' RH$, which is right angled at R, we have

$$RC_A' = C_N M = HC_A' \sin \omega.$$

As has already been noted, to $\omega = 45°$, there would correspond $t_2 = t_0$ and $HC_A' = S$; in such case we should have

$$C_N M = S \sin 45° = 0.7S,$$

and hence the speed V_N necessary to allow C_N to arrive at M when the center of A reaches C_A' would be given by

$$V_N t_0 = 0.7S,$$

or

$$V_N = 0.7 V_A.$$

When $\omega < 45°$ a smaller value of V_N than this would be sufficient; this shows that, *although the counter-move of N may not* be immediate, if the party N possesses a speed about equal to that of the enemy, this speed will be sufficient to permit C_N to arrive on the line $C_A' M$ and even to pass beyond it. So, then, at the end of the abovementioned wheel the party A might be in a relative position so different from the one prognosticated as to render another evolution necessary. In order not to run such risk the amplitude ω of the wheel should evidently be 90°, and the pivot should be on the ship at one-third from the head of the column. But it is also well to reflect that, besides the evolutionary rapidity, it is important, as regards the advantages of position, not to change the alignment any more than is necessary; for this reason, everything considered, it seems that in the case in question the evolution performed in succession would be preferable for A, unless the extreme ships are very swift.

As is well known, in simultaneous changes of direction, every ship must wait for the movement to be begun by the adjacent inner ship on the side toward which the change is made; for this reason the changes of direction that are called simultaneous are practically successive changes at very short intervals of time. Conformably to this, in order to execute such changes with the maximum promptness, it is to be borne in mind that the inner

ship on the side toward which the change is made can haul down the signal and begin the movement as soon as the signal is repeated by the adjacent ship.

A particular case worthy of consideration is that of a fleet in column of vessels that desires rapidly to invert the course. It is not impossible that this may be required in order to stop an abrupt movement of the enemy, as happened to the Japanese at the battle of Tsushima. In such case the simultaneous change of direction would contemporaneously disorganize the firing of the whole fleet; therefore, the example of Togo is to be imitated by making the ships of each division change together, and the divisions change in succession so that, during the movement, one division remains protecting the other with its fire.

62. *T Positions.*—To the criteria established for the conduct of a fleet in a simple alignment in offensive contact it is well to add a few observations directly regarding the object that the maneuver must have in view.

I. It is incontrovertible that the ideal object would be that of crossing the *T;* but with two compact fleets it is obvious that this cannot be accomplished, no matter how small the maneuvering qualities of the enemy may be. Therefore, it is not necessary to sacrifice the maneuvering in the least in order to tend toward this ideal. The *immediate* tactical situation must be kept in view, seeking above everything else to maintain oneself in fundamental position while still tending toward crossing the *T*. Very small importance should then be attributed to the study of maneuvers based upon a preconception of passive conduct on the part of the enemy. Let us give an example of this.

Supposing two adversaries in column of vessels, if one of them keeps the course unchanged, then the other, possessing greater speed and his column leader steering with a certain sight-vane angle, can reach a sector of minimum offense of the enemy's fleet. Given the speed ratio and the limits within which it is desired to keep the variation of the distance, the opportune sight-vane angle might be graphically deduced and the various angles afterwards registered in a table, the practical importance of which we may value with the following consideration.

It is not impossible that, by concentrating the fire on the leading ship of the enemy's line, we may deprive the said line of its chief; for this it would be necessary that the flagship initially lead the line; that, the commander-in-chief being dead, the signal trans-

ferring the command be not seen; and that the commander of the leading ship, being without orders, should keep the course unchanged, as happened at the battle of August 10, 1904. But this is a very particular case, and it is logical to believe that the enemy will so act as to avoid it, considering this hypothesis to be among those generally prescribed for tactical contact. Then, the maneuvering commenced with the sight-vane angle supplied by the table would not answer to any rational conception; rather, it is easy to believe that the table would be a useless shackle, even in case the enemy should behave in the aforesaid passive manner, because, the maneuvers inspired by the criteria generally admitted in the preceding sections would answer better.

II. From what has been said in the preceding chapter (section 56), it is to be predicted that, at the beginning of offensive contact, the positions of the two adversaries will not be tactically equivalent; it is even not illogical to affirm that, while generally excluding the probability—as has just been observed—that the ideal crossing of the *T* may be completely secured, it will be at the initial moment that it will be possible to approach that ideal.

In order to fix the idea, let us note that, at Tsushima, the fleet of Togo, finding itself forward of the enemy's beam at the moment of sighting him, if it had steered on a line of bearing directly on the course of the latter, it would presumably have been able to establish offensive contact in a more predominant position than the one obtained with the inclined course and with the formation in column of vessels.

So, then, the example of the preceding section shows that if one of the adversaries is in an advantageous position, the evolution of the enemy intended to establish superiority or at least tactical equivalence, will hardly completely attain its object, it being very easy to execute the counter-movement to such an evolution; on the contrary, if instead of supposing—as in the said example—that the party *N*, after having crossed the *T*, has taken a course parallel to that of *A*, we imagine that it maneuvers according to the criteria deduced in section 59, the counter-movement to *A*'s evolution might not always be necessary. In such case it is true that *A* might succeed in assuming an equivalent alignment; nevertheless, even when this is reached, the ships of *A*, being in column of vessels, will not find themselves in the best defensive conditions, and it will still remain to them to execute a simultaneous change of direction, with disturbance to the firing, in order effectively to

establish conditions of equivalence; while the ships of *N* will have been all the time in the best possible conditions from the offensive and defensive points of view. For this reason, and on account of the difficulty of properly estimating the variability of the tactical situation during the evolution, it is to be presumed that some portion of an advantage of position will always remain; and if we bear in mind, as already noted in section 25, that the advantages obtained produce a compound effect, that victory is the integration of small advantages, each one of which, separately considered, might seem negligible, we must recognize *the great importance to be attributed to the initial tactical situation.*

III. Having had the good fortune to cross the *T,* in order to maintain the relative position with respect to the enemy, it is necessary to change to a parallel course; but it seems logical to limit this rule to cases in which its application does not imply a sacrifice of offensive power. In fact it is not presumable that the enemy will not maneuver to extricate himself from his critical position, and hence, proposing to oneself the object of maintaining the position with a sacrifice of offensive power, although the latter may prove to be all sufficient, would seem to be aiming at an illusory object, to obtain which one will find himself obliged to execute two changes of course at very short intervals of time. Thus, having crossed the *T* with respect to a fleet in column of vessels, if one were to change his course, one-half of his principal armament would quickly go out of action. Let us suppose further that in this way one might remain in the advantageous position for a time double that which would remain to him when developing the maximum offensive power; the minor duration of the advantage would be compensated in the second case by the greater total result. For the rest, under the wild hypothesis that the enemy does not maneuver, one might keep himself in the sector of minimum offense of the enemy's alignment, still developing the maximum intensity of fire; indeed, it would suffice to execute an opportune change of course on arriving in proximity to the limit of the aforesaid sector.

63. *Maneuvering on a Double Alignment.*—It is well known that the experiments carried out in France with the already mentioned Fournier system of tactics, have brought to light the inconveniences of the double alignment in offensive contact.

The illustrious admiral proposed to himself, by dividing the fleet into tactical units each formed by three ships, to obtain great

manageability by virtue of the shortening of the line. For this purpose, the group-leading ships, as well as the units composing such groups, must not be held rigidly bound to the formation, but must move opportunely on their own initiative in order to secure the best utilization of the guns. Nevertheless, in practice, the ships of the outer line, obliged to fire at targets that present themselves between friendly ships, cannot always be in the desired position; *frequent changes of the target constitute the inevitable inconvenience of the double alignment.*

On the other hand, in the preceding chapter (section 55), it has been made evident that such a form of alignment has scant evolutionary capacity; or, the manageability deriving from the shortening of the line is only apparent. In order to tend toward this object it might be prescribed that the distance between ships could be shorter than that held to be necessary for the simple alignment; but there would then result a limitation of the movements, it being necessary to abandon simultaneous changes of course; and the anxieties of maneuvering would be increased.

Finally, as we have already noted in Chapter II of Part I (section 11), the launching of torpedoes for the maximum run against a fleet, while it is not rational if the enemy's alignment is a simple one, may have a probability of success against a fleet in two lines.

For these reasons we hold that, unless we have a very numerous fleet, the adoption of the double alignment is to be restricted to cases in which we ought to utilize in the second line any antiquated ships, limiting their number, however, as is set down in section 56.

64. *Maneuvering by Independent Groups.*—Let us suppose a fleet broken up into groups each one of which has a speed not inferior to that of the enemy's fleet; that is to say, the condition recognized in section 57 as necessary for obtaining a good initial situation is satisfied.

It is true, as we noted in section 20, that the compact fleet, by assuming an opportune angular alignment, may bring itself into conditions of equivalence with respect to the enemy that is divided into groups; it is obvious, however, that, in practice, it will not succeed in obtaining these conditions continuously, because the divisions of the compact fleet cannot always satisfy the double condition of keeping together, and having, each one of them, an alignment in fundamental position with respect to the corresponding group of the enemy, besides having the ships in-

clined to the alignment in a way suitable for the development of the maximum offensive power. The tactical government of the compact fleet will have to satisfy too many conditions, owing to which the said compact fleet will be notably a poorer maneuverer than the enemy.

The advantage of maneuvering by groups being derived from this idea, it is clear that such advantage will be maximum when one of the groups is composed of a few ships (not more than six) endowed with very high speed. The maneuvering of this division, called the *flying squadron*, must be developed in a way such as to produce the maximum rapidity of rotation of the line joining it with the adversary; then it is to be presumed that it can enter a sector of maximum offense.

The number of ships of the flying squadron having to be limited, as has just been said, it appears to be clear that it is important that each of these ships should have a powerful armament. The type adapted to such a purpose is then that of a very swift armored ship, with a speed of at least four or five knots greater than the types that are constructed for composing the principal squadrons, with a powerful armament, and with the best protection possible subordinately to the development of the offensive capacity and the mobility.

From what has already been established, the flying squadron must generally be kept at the same distance from the enemy as the principal squadron; but when the distance falls near to the lower limit of the mean distance (3500 meters) a closing in maneuver by the flying squadron is not to be deemed rash, trusting that if the enemy commits the error of maneuvering to engage with the said group, he will place himself in conditions of inferiority with the opposing principal squadron. If, on the other hand, this were attempted at a greater distance, given the time that would be required for a considerable approach, the flying squadron would risk being overpowered.

Conformably to what we have set forth in section 62, III, the flying squadron must not sacrifice the development of the maximum offensive power to the maintenance of a *T* position.

65. *Maneuvering at Close Quarters.*—We now propose to see how the criteria established in section 46 for the maneuvering of a single ship within the limits of a fight at close quarters may be extended to a fleet of ships. Even if, as is to be presumed, the

two adversaries do not maneuver with the principal object of ramming, they must run to meet each other.

For convenience of reasoning, let us begin by considering the hypothesis that a group composed of several ships is fighting an isolated ship; and let us ask ourselves the following question: Given that the ships of the group desire to ram the enemy's ship, what could be the formation and the most opportune maneuver?

Let us observe that it would be exceedingly dangerous for the ships of the group to execute a maneuver which might have for its object the concentration of the rams; we mean by this that if, for example, the ships of the group are two, *A* and *B*, disposed in line abreast, and if the enemy's ship *C* steers for the center of their formation, the two ships *A* and *B* cannot attempt simultaneously to ram *C* without risking ramming each other. In other words, *A*, for example, can head for *C*, and *B* must change course parallel to *A*; while *C*, in so far as the ram is concerned, will in this way have to do with but one ship.

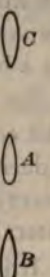


FIG. 40.

This simple fact must be kept in mind because it shows that any maneuver based upon the concentration of the rams must be abandoned; and that, instead, for the employment of these weapons, it is necessary to base it on successive action. In order that the action may assume this second form, the formation of the group must needs be a deep one; *consequently the column of vessels may be considered as the fundamental position.*

The column leader of the group steers for the enemy's ship; the two ships pass close to each other; the second ship in the line maneuvers with respect to the enemy without troubling itself to follow the column leader in succession, and so on.

It is here necessary to observe that the conditions of the ship that fights with the group grow worse the greater is the depth of the latter's formation, up to a certain limit. With this we desire to refer, not only to the greater number of ships that successively attempt to ram, but also to the offensive returns of the same. Since, indeed, within the limit of their close approach, each ship has the maximum interest in keeping the bow on the enemy, the ship *A* (Fig. 40), after passing *C*, turns with the helm hard over so as to come again to a meeting with *C;* and, analogously, *C* would wish to turn also, but cannot do so on account of *B*, who imitates the maneuver performed by *A*. The ship *C* is hence

prevented from inverting the course, and consequently finds itself in a condition of grave inferiority with respect to *A*, unless it has more speed or possesses better evolutionary qualities. The group is so much the better disposed for this purpose the more the depth of its formation approaches that necessary for giving *A* a notable advantage with respect to *C* in the inversion of the course. It is understood that in increasing the depth of formation beyond a certain limit, the advantage ceases to exist.

Passing from the particular case considered to the more general one of two groups on the basis of the ram only, it results from this that a group that moves in line abreast against another in a formation nearly approaching that of a column of vessels, is in an inferior position; it suffices that the ships of the latter group be not bound to maintain the formation, but may consider it only as a basis for the maneuvering.

Let us now see what conclusions may be reached in relation to the employment of the torpedo. We begin as usual with considering the hypothesis of a group of ships that attack a single enemy's ship; both the adversaries are supposed to be armed with lateral launching tubes.

It is easily seen that the group must do its best to have its own ships pass successively on the same side of the enemy. As a matter of fact, if the group is composed of two ships, it will be able to use its torpedoes as well if the enemy's ship passes between the ships of the group, as if it leaves them both on the same hand; but in the first case (which is that in which the ships of the group are not in column of vessels) the group permits the enemy to put forth his maximum offense by launching torpedoes from both sides. For this reason it is obvious that the first method of action is preferable, even when the ships of the group are more than two.

At this point the object of the maneuvering of the group appears to be thus determined: *To pass by on the same side of the enemy's ship.* The maneuvers should then be about that in column of vessels and in succession. Inversely, the ship that fights the aforesaid group should maneuver so as to pass between the ships of that group.

Let us now suppose the two groups to be equally armed with torpedoes, and let us imagine that the first has a front formation, and the other a deep formation. For example, let four be the number of ships composing each group, and let us indicate by

A, B, C, D (Fig. 41) the ships of the first group, and by A_1, B_1, C_1, D_1, those of the second.

If, in order to consider a special hypothesis, we imagine the first group to be formed in a square and the second in column of vessels, as shown in the figure, it is evident that, as regards the torpedo, the group A_1, B_1, C_1, D_1, during the passage by, will be in better conditions than the other, because it can fire twice the number of torpedoes.

As the same reasoning might be repeated for formations analogous to those considered, we may affirm that the object of the maneuver in battle at close quarters, must, with regard to the use of the torpedo, be that of obliging the enemy's ships always to present the same side in passing by; and inversely, each ship, bearing in mind the object just mentioned, must seek to pass between the enemy's ships so as to launch the greater number of torpedoes.

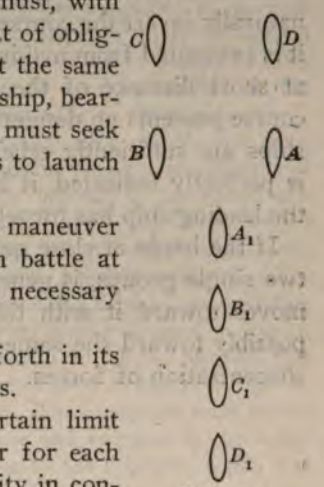


FIG. 41.

It results from the foregoing that the maneuver for the employment of the torpedo in battle at close quarters harmonizes with what is necessary for the possibility of ramming.

Let us now place what we have set forth in its relation to the employment of the guns.

It being admitted that, within a certain limit of distance, the adversaries must steer for each other, it is well to consider this necessity in connection with the other necessity of firing with the maximum number of guns permitted by the development of the action; consequently, while in long-range battle, a ship has to keep the enemy bearing in a sector of maximum offense, inside of the aforesaid limit it would be in a position which permits of firing in the direction of the bow. Not only does the line abreast satisfy this condition, but also any other formation in a straight or curved line which permits the ships to fire ahead.

Summing up, we may note that, considering the three weapons together, the best arrangement for the ships in battle at close quarters is that which permits the simultaneous employment of the forward guns, and differs as little as possible from the column of vessels; in other words, it is a question of a line of bearing that makes a small angle with the direction of the course.

In steering for battle at close quarters the ships of each group must hence take, by prompt formation (any other method is evidently impossible), the aforesaid position with respect to the most advanced ship in the direction of the course; doubtless the distance between ships will not be the same, and, in fact, the formation will differ in practice from a line of bearing; but there is no need to trouble about that. In effect, it is sufficient for the ships to be echeloned on the side that possibly will be indicated by the admiral, or that the situation with respect to the enemy shows to be opportune.

Each ship of the group, after passing by the enemy, must naturally invert the course in order to run again upon him, unless it is prevented from making such a movement by the quick arrival at short distance of the enemy's ships. This inversion of the course presents no dangers of collision with friendly forces if the ships are sufficiently echeloned in depth and the opportune side is perfectly indicated, it being naturally the same toward which the leading ship has turned.

If the battle at close quarters, instead of taking place between two single groups, is general, according to the foregoing a party moves toward it with the single groups following each other, possibly toward the same part of the enemy, so as to obtain the concentration of forces.

DISCUSSION.

Collision between H. M. S. "Hawke" and R. M. S. "Olympic."

(See No. 140.)

Naval Constructor D. W. Taylor, U. S. Navy.—Referring to Lieutenant Nixon's account of the *Hawke-Olympic* collision I must say that I was very sorry to see this published in the Naval Institute Proceedings. Suits arising from the collision were in court and undecided at the time and such a publication could not have been made in England without serious danger that the author and the publisher would be punished. The matter being *sub-judice* I do not think it good policy to publish in the Institute any article ascribing blame or responsibility to either side.

It is well known that no two witnesses will give exactly the same account of even a simple occurrence. Lieutenant Nixon's recollection of the circumstances of the collision is not only opposed to the sworn evidence of a number of officers of the English Navy which was accepted as correct by the court, but is inconsistent in material respects with facts demonstrated in court by the strongest possible evidence. For instance, Lieutenant Nixon, in Fig. 1, represents the *Olympic* as intending to pass north of the Ryde Middle, called the Middle Ground in Fig. 1. Every witness from the *Olympic*, in a position to know, testified that after rounding the West Bramble Buoy she steered a course S. 59° E. intending to pass south of the Ryde Middle. The appended chart shows the place of collision as claimed by the *Hawke* and accepted by the court. It also shows the place of collision according to the *Olympic*, which was rejected by the court. It also shows in full lines the courses of the *Olympic*, S. 59° E., and of the *Hawke*, S. 74° E. prior to the collision as fixed by the court.

The place of collision fixed by Lieutenant Nixon is far removed from even the place claimed by the *Olympic*.

Lieutenant Nixon's statement that on board the *Olympic* "nothing was done either with helm or engines" is contrary to positive testimony from the people on the bridge of the *Olympic* that when the *Hawke* sheered in the *Olympic* helm was put hard a-port before the collision. As to his doubt "that anyone on the *Olympic's* bridge had the slightest warning of the collision until the instant of actual impact" there was positive testimony from the *Olympic's* people on the bridge that they saw the beginning or early stages of the swerve. The captain of the *Olympic*, with reference to the time from the beginning of the swerve to the instant of collision, said "it seemed a long time but under a minute." The captain of the *Hawke* thought the time about 40 seconds. There seems little doubt that Lieutenant Nixon's account, with reference to what the *Olympic's* people did and saw, is materially in error.

While not very clear, Lieutenant Nixon's account appears to be that the *Hawke* was gaining on the *Olympic* until she began to swerve. From the time when the *Hawke* was "coming up fast" and "just beginning to lap" the *Olympic* to the beginning of the swerve he allows two intervals each of "a few seconds" only.

In the suits there was testimony from both sides that at the beginning of the swerve the *Olympic* was going faster than the *Hawke*. The *Olympic's* officers on her bridge—but not all the witnesses on that side—testified that the *Hawke* gained until her stem was about abreast the *Olympic's* bridge and then the *Olympic* drew ahead and had gained about 200 feet when the swerve began with the *Hawke's* stem about abreast the center of the *Olympic*. The *Hawke* witnesses also put their stem as abreast the middle of the *Olympic* at the beginning of the swerve, but claimed to be much further ahead at the time the *Olympic* began to draw ahead. Lieutenant Nixon's account is inconsistent with both of the others. Of course, as I said before, no two witnesses will give exactly the same account of a given occurrence, but if Lieutenant Nixon's recollection is even approximately correct as to many of the most important circumstances there were certainly a number of exceptionally unreliable observers on the *Hawke* and *Olympic*.

I append hereto the decision of the judge, Sir Samuel Evans, in the suits growing out of the collision which gives much information about the testimony, etc., together with a most acute analysis of it and the reasons for the findings of fact. The appended chart will facilitate following the decision. It is not a part of the judgment, being prepared on the government side, but it will be seen that its accuracy is virtually sustained in the decision. Dotted lines connect simultaneous positions of the two ships claimed by the *Hawke* side. The times marked for these simultaneous positions differ by a minute because they are the two times of the two ships whose clocks were a minute apart.

As supplementing the information given in the decision it may be interesting to recite briefly the happenings on the *Hawke* immediately before and after the collision, as told by her witnesses. The commanding officer—Commander Blunt—was in charge and on top of the pilot house which is on the bridge. The steering wheel is in the pilot house at the level of the bridge and the engine telegraphs on the bridge near the center.

As soon as Commander Blunt saw the Old Castle Buoy clear of the red conical buoy off the end of Prince Consort Shoal, he gave the order port 5 degrees. The *Hawke* answered her port helm and had swung through 6 to 10 degrees when she ceased to swing to starboard and began to swerve rapidly to port. When Commander Blunt observed this his first order was "hard aport" which he followed almost immediately by the order "stop port; full astern starboard." As that order was being given the helm was reported jammed. Something jammed after the helm had been put over 15 degrees and three men were unable to move the steering wheel. Immediately after the collision the steering gear was in perfect working order and the cause of the jamming has never been ascertained. On giving the order "stop port; full astern starboard" Commander Blunt

sprang to the head of the port ladder leading to the bridge from which he could see the telegraph. When the helm was reported jammed he made one leap to the bottom of the ladder giving the order "full astern both" and himself threw the port telegraph which had been put at "stop" to "full astern." The starboard telegraph was already at "full astern." The engines of the *Hawke* were going astern at the time of the blow. The upper part of the *Hawke's* stem appears to have held strongest to the *Olympic* and as the latter drew clear the pull on the *Hawke* heeled her over about 15 degrees to starboard. Her head, of course, swung to starboard also and she was turned completely around and backed across the *Olympic's* wake before the engines were stopped. The compass card was spinning so that it was impossible to take bearings at first. Several minutes after the collision bearings were taken and the *Hawke* located at the point marked 12.50 on the chart.

I may say in conclusion that while fully agreeing with Lieutenant Nixon that the swerve of the *Hawke* was initiated by suction, so called, I am strongly of the opinion that had the *Hawke* approached the *Olympic* in the manner described by him the effect of suction upon her would have produced results very different from those that actually took place. This, however, being somewhat a matter of opinion, I have restricted my discussion to matter concerning which the evidence on the trial for both sides seemed to render it practically certain that Lieutenant Nixon's recollections were erroneous.

A study of the decision will show that as regards some further matters I have not touched on, the findings of the judge as to the facts, arrived at after weighing and analyzing contradictory evidence, differ a good deal from Lieutenant Nixon's recollections.

TRANSCRIPT OF THE OFFICIAL SHORTHAND WRITER'S NOTE OF THE JUDGMENT.

THE PRESIDENT.—These two actions relate to a collision which took place between the SS. *Olympic* and H.M.S. *Hawke*, on the 20th September, 1911, off Cowes, Isle of Wight.

The first was brought by the SS. *Olympic* against Commander F. Blunt, of H.M.S. *Hawke*. The second was brought by the Commissioners for Executing the Office of Lord High Admiral of the United Kingdom against the owners of the SS. *Olympic*.

The first action was brought against the commander because no action lies against the Admiralty Commissioners, but in substance the plaintiffs in the one were in the position of the defendants in the other, and vice versa.

The two actions were tried together, and involved identically the same questions with reference to the cause of the collision. They were tried together by consent. The case for the *Olympic* was opened first.

The collision took place on a fine day, not long after midday, in an open channel. The situation was free, and was not complicated by the presence, or navigation of any other vessels. One of the colliding vessels was the largest and finest product of the shipbuilding enterprise and skill

of the first maritime nation of the world; the other was one of the protected cruisers of her navy. The contemplation of the calamity, and of the damage which resulted from it, cannot but produce a feeling of regret, and even a sense of pain.

It ought not to have happened, but it did happen, and I have, to the best of my ability, to decide upon the evidence how and why it happened, and who are, or is, to be blamed for it, according to the law of Admiralty.

The *Olympic* is a triple screw steamship, of 45,000 tons gross, and 24,000 tons net register, of 882½ feet in length, of 92½ feet beam, fitted with turbine and reciprocating engines, with a combined power equal to 59,000 horse-power indicated, and manned by a crew of 885 hands all told. Her draft at the material time was 33 feet 6 inches forward and 34 feet aft. Her displacement at a mean draft of 33 feet 6 inches in sea water is 50,500 tons, and at 34 feet 51,340 tons. She is a veritable "Leviathan that maketh the deep to boil like a pot."

H.M.S. *Hawke* is a twin-screw first-class protected cruiser of 360 feet length, of 60 feet beam, with an indicated horse-power of 10,000 indicated with natural draft and 12,000 with forced draft. At the material time she was drawing 22 feet 4 inches of water forward, and 24 feet 6 inches aft. Her displacement was approximately 7600 tons.

The bridge of the *Olympic* was 190 feet abaft her stem, that of the *Hawke* was 91 feet abaft hers; so that in proportion to the lengths of the vessels the position of the bridge on each was approximately the same.

The *Olympic* was proceeding from Southampton water towards Spithead through the channel south of the Ryde Middle Bank on her fourth voyage across the Atlantic. The *Hawke* was proceeding from the Solent towards the Nab Lightship through the same channel in the course of making her annual power trials. In these trials a certain power of the engines is developed for a certain period, for the purpose of not only testing the engines, but of testing the engine-room complement and their capacity and power for keeping steam. The trials had no concern with speeds; but speeds were taken for navigation purposes.

The vessels sighted each other between 3 and 4 miles distant. At that time the *Olympic* was coming down in the Thorn Channel—which is a deep-dredged channel—near the North Thorn Buoy, and the *Hawke* was going up the Solent, in the vicinity of the Gurnard Ledge Buoy. Each had the other more or less on her port bow at that time.

They both proceeded on their ways, and about 4 minutes later, the *Olympic* blew two short blasts expressly for the *Hawke*, in order to let the *Hawke* know that she was on the starboard helm, and bound for the eastern passage through the channel towards Spithead. This signal was blown when the *Olympic* was about two-thirds of the way between the Thorn Knoll Buoy and the West Bramble Buoy; and thereupon the *Olympic* began to take her turn around West Bramble Buoy to get into the channel. The distance between the vessels was from a mile to a mile and a half when the signal was sounded.

The cruiser at this time was getting near Egypt Point (Isle of Wight), and had the *Olympic* broader on her port bow. In turning the *Olympic's*

starboard bow was exhibited to the port bow of the *Hawke*. As the *Olympic* was turning on starboard helm to round the West Bramble Buoy to get into the channel, the *Hawke* was turning on port helm to round Egypt Point, to get into the same channel.

It was said for each vessel that after her turn was completed, she straightened on a definite course, which was kept practically until the throes of the collision. What these courses were will be discussed and decided later. The distance from the place where the commander of the *Olympic* said she was steadied on her course, and the spot where he marked the collision was a little under 9 cables, viz.: 1770 yards.

The distance from the place where the commander of the *Hawke* said the cruiser was steadied on her course to the spot where he marked the collision was 11 cables, or 2200 yards.

Although the respective positions, courses, and speeds of the two vessels at earlier stages have to be looked at for some purposes, it is mainly, if not entirely, upon their respective positions, courses and speeds, at and from the time when they straightened on the final courses that the decision of these actions depends.

It will be convenient now to state what the case was which was put forward on behalf of each vessel. It can be done quite briefly.

The case for the *Olympic* was that the *Hawke* was at all material times the overtaking vessel; and that, as such, the duty lay upon her to keep out of the way of the *Olympic* as the overtaken vessel, under the Article of the King's Regulations, which corresponds with Article 24 of the Regulations for Preventing Collisions at Sea, and that she committed a breach of that duty.

The case for the *Hawke* was that at all material times the two vessels were crossing vessels within the meaning of Article 19 of the last named regulations, and the corresponding Article of the King's Regulations, and that as the *Olympic* had the *Hawke* on her own starboard side, the duty lay upon her to keep out of the way of the *Hawke* and that she (the *Olympic*) committed a breach of that duty.

Whichever vessel had to keep out of the way of the other, there was a corresponding duty upon that other under the regulations to keep her course and speed.

These were the main contentions, and to these the mass of the evidence and the arguments were directed. There are other matters which arise, and must be dealt with, viz.: the allegation that at the last moment action ought to have been taken by one ship or the other to avert the collision, even though the initial blame was on the other; and also the defence of compulsory pilotage, and the counter allegation that if the fault lay with the *Olympic*, her compulsory pilot was not solely to blame.

I now propose to deal with the main issue. Was the *Hawke* the overtaking vessel, and the *Olympic* the overtaken vessel? Or were they crossing vessels?

In order to determine this issue, it is necessary to look at the whole of the evidence, and especially to come to a conclusion as to the spot of the collision, the courses of the vessels, their speeds, their bearings, their distances, and their helm actions at the material times.

An overtaking vessel is defined as one "Coming up with another vessel from any direction more than 2 points abaft her beam, *i. e.*, in such a position, with reference to the vessel which she is overtaking, that at night she would be unable to see either of that vessel's side lights." Crossing vessels are vessels travelling upon converging courses so as to involve risk of collision.

The *Olympic* set out to prove a story which may briefly, but with substantial accuracy be stated as follows: That after passing the North Thorn Buoy (where her speed was 17½ knots) she reduced her speed, and that from that point up to just before the collision, the *Hawke* was travelling at a greater speed; that after turning the West Bramble Buoy she straightened on a course of S. 59° E.; that when she steadied on this course, the *Hawke* was at least a quarter of a mile astern, bearing about 2½ or 3 points on her starboard quarter: that the *Hawke* was on a parallel course with her for about a mile before the collision, and distant laterally about 300 yards; that from the position astern, the *Hawke* came up to and overtook her, and that when the stem of the *Hawke* was opposite her bridge, she had attained the greater speed and shot ahead, and the *Hawke* fell astern; and finally that the *Hawke* starboarded right into her starboard quarter, and struck her almost a right angle, about 80 or 90 feet from her stern.

On the other hand the story of the *Hawke*, stated in a similar way briefly, but with substantial accuracy, was as follows: That she came up the Solent on a course N. 77° E., and turned round Egypt Point at a distance of about 3½ cables from the land, that by reason of the presence and course of the *Olympic* she steered a course of S. 74° E., intending to pass the three buoys outside Cowes, viz., the West Conical, the Chequer, and the East Conical (also called the Prince Consort) Buoy at a distance of between 20 and 30 yards on the north side; that her speed was less than that of the *Olympic*, and that she was never overtaking; that the vessels were on converging courses of 15 degrees; that the *Olympic* came within about 100 yards of her, and that in comparatively shallow water by certain forces called suction, or interaction, she was at last, when brought into this close proximity, drawn into the *Olympic* so that she collided at an angle of something between 4 and 5 points.

The case depends upon fact, rather than upon law. It is not only an important case, it is also in many respects complicated. But, after full and careful consideration, I have arrived at definite and clear conclusions.

In order to test the evidence, especially the evidence which consists of impressions, opinions, and observations (of greater or less accuracy) it is desirable and indeed essential, to determine certain matters which ought to be capable of fairly correct ascertainment.

In the first place, if the spot of the collision can be fixed, we have one of the chief determining factors of distances, of courses, and of bearings.

In the next place, if the speeds of the vessels can be ascertained, or even approximately ascertained, a useful test is provided for bearings, courses, and distances.

The place of collision was in dispute. It was regarded and properly regarded, by both parties as a very important matter. It was only vaguely

stated in the Preliminary Acts and Pleadings. In the interlocutory stage of the proceedings, about a fortnight before the trial, I made an order that each party should mark upon a chart, as particulars in the actions, the place of collision as alleged, and I ordered that the charts so marked should be exchanged at the same time, so that neither party should know beforehand where the place would be fixed by the opponent. The places were marked, and the marked charts were exchanged accordingly.

The spot fixed by the *Olympic* was about 220 yards to the N.N.E. of that fixed by the *Hawke*. These two spots I call "The *Olympic's* place of collision"—and "The *Hawke's* place of collision," respectively, and, according to the ordinary rules of practice in legal proceedings, each party ought to be bound, as by particulars, to the places so marked.

At the trial three of the chief witnesses for the *Olympic* were required to, and did state and mark the place where they said the collision occurred. They were Captain Smith, the pilot, and Colonel Sexton White. Neither of them agreed with "The *Olympic's* place of collision." Nor did any of them agree with either of the others as to the spot. Captain Smith marked a spot about 260 yards to the N.W. of the *Olympic's* place of collision, and the pilot a spot about 420 yards to the N.W., and Colonel White a spot about 650 yards to the S.E.

The *Hawke's* place of collision was deposed to by Lieutenant Aylen, the navigating officer of the *Hawke*, and by Commander Blunt.

It was fixed by reference to a position taken a few minutes after the collision, when the *Hawke* came to rest, by Lieutenant Aylen by the direction of Commander Blunt. This position was taken by means of two sets of bearings, and was logged by Lieutenant Aylen at the time. By a mistake it was logged as the place where the "ship was struck." Lieutenant Aylen said he made the entry "ship struck" in the hurry and excitement of the moment; but that that position was really that in which the ship came to rest. I believe this statement. I also believe that the spot to the southward and westward which was marked as the *Hawke's* place of collision was, as nearly as can be ascertained, the actual spot of the collision.

The *Olympic's* witnesses did not fix their places of collision with reference to any accurate bearings.

Their positions were only given as the result of general impression, and as stated they all varied, and varied considerably.

I accordingly decide for the purposes of this case that the *Hawke's* place of collision is where it must be taken to have actually occurred. I now state by comparison, and for reference, the distance from the various spots of collision spoken to by the three before-named witnesses for the *Olympic*, to what I have decided was the actual place of collision. Captain Smith gives his, 400 yards away in a direction about N. by W. The pilot gives his, 540 yards away about N.N.W., Colonel White gives his, 650 yards away about E.S.E.

The place of collision will be very important, as I afterwards point out, in deciding as to the course of the two vessels and the lines of those courses in the channel.

Now as to speeds. The maximum speed of the *Olympic* in the open sea is about 22½ or 23 knots an hour. The maximum "reduced speed"—*i. e.*, in channels like the Solent—is about 20 knots. Half reduced speed is about 15 knots. In getting up to North Thorn Buoy the *Olympic* was going through the water 17 or 17½ knots. She slowed to make the turn round the West Bramble Buoy, until her speed at the end of the turn and when she steadied on her course was said to be 11 or 12 knots; whether it was as low as this is doubtful. All engines were then put full speed ahead, and it was pleaded and stated in evidence, at the time of the collision, her speed through the water was 16 knots Her captain said that from about 12 knots it would take her three or four minutes to attain her maximum reduced speed of 20 knots. Professor Biles, by his calculations, supported that statement. This evidence is, in my opinion, more reliable than that from the engine room upon this matter. According to her recorded times she straightened on her course at 12.43 p. m., and the collision happened at 12.46 p. m. This means a minimum of 3 minutes; and a maximum of 4 minutes, because the times taken were from electric clocks which (with the exception of the master clock) jumped a minute at a time, and did not record anything between the minutes. In this interval I think she must have reached a speed nearer 20 knots than 16 knots.

This question of her speed between the time she straightened on her course and her colliding, can be tested or checked in various ways. The distance from the North Thorn Buoy to the *Olympic's* place of collision as she went, is 2½ knots. According to the log the time in which this distance was covered is 9 minutes; this gives an average speed of 16.6 knots an hour—and it includes the lower speed in rounding the buoys. If a mean time of 9½ minutes is taken, the average speed would be 15.8 knots; and if a full ten minutes is taken the average would be 15 knots. The distance to the actual place of collision is greater, and the average speeds would accordingly be somewhat higher in each case. From the Thorn Knoll Buoy to the *Olympic's* place of collision the distance is about 19½ cables. The time given in the *Olympic's* log for travelling this distance is 6 minutes—that gives an average speed of 19 knots an hour. At the mean of 6½ minutes, the average speed would be 17.3 knots an hour, and at the full 7 minutes, the average would be 16.7 knots an hour. Again, the distance to the actual place of collision is greater, and the average speeds in the three instances would be higher accordingly.

Similar calculations for one more distance will suffice, viz., that between the position in which the *Olympic* straightened on her course after the turn, as fixed by her captain and the actual place of collision. This measures 1 knot. The time recorded in her log for this distance is 3 minutes. This gives an average speed of 20 knots an hour. If the mean is taken as before as between 3 and 4 minutes, the average speed is over 17 knots an hour, and taking the full 4 minutes there is an average speed of 15 knots.

The conclusion to which I have come is that the speed of the *Olympic* at the time of the collision, and for a few minutes preceding it, was greater than that stated by her witnesses.

The speed of the *Hawke* can be fixed with more certainty. The cruiser was, as stated, on power trials. Commander Blunt and others gave evidence that her speed was 15¼ knots at and for some time before the accident.

Between 7.30 and 11.30 a. m. she had been engaged in making trials of her full natural draft power (which is equal to four-fifths of the forced draft power) and from 11.30 up to the accident in making trials of her three-fifths natural draft power. For the former trials the number of revolutions made were 92 per minute. If the bottom of the cruiser had been clean, the speed on that number of revolutions would have been 18.4 knots: five revolutions per minute being equal to a knot per hour. But she had not been in dock for a year, and her bottom was in a state which impeded her designed speed, and the results obtained were an average of only 17 knots an hour. For the three-fifths trials from 11.30 o'clock the number of revolutions was eased down to and kept at 82. This was proved by the engine-room log and by several witnesses. If the bottom of the ship had been clean this would have given a speed of 16.4 knots, but in the state in which she was, she would fall short of this, and in proportion as before her speed would be only a little over 15 knots.

This, I find upon the evidence, was about the speed of the *Hawke* for some time before, and at the time of, the collision.

I now come to the consideration of the important matters of the courses and bearings of the two vessels.

First, with regard to the courses of the *Olympic*. They are not in any uncertainty. When she first sighted the cruiser she was on a course of S. 65° W. magnetic, and this course was continued till she starboarded for rounding the West Bramble Buoy. When she gave the two-blast signal for this helm action, she had the cruiser on her starboard bow. After she finished the turn she steadied on her new course, which was S. 59° E. This course had previously been entered in her log as follows: West Bramble to Peel Buoy, S. 59° E."

She remained on it until immediately before the blow, when her helm was put hard-aport, which altered her heading about a point.

There is no doubt about this course of S. 59° E. The position of the vessel in the channel depended, of course, upon the place where she was when the course was set. About this there was considerable dispute. The *Olympic's* witnesses placed her much more to the north of the channel than those for the *Hawke* did. This question and the other connected with it, namely, the position of the *Hawke* in the same channel when she got on her last course before the accident, is all important and required careful investigation. This will be done a little later.

Next as to the course of the *Hawke*.

When she first sighted the *Olympic* her course was N. 77½° E. magnetic. The commander said that by reason of the presence of the *Olympic* he turned Egypt Point, and put his vessel on a course of S. 74° E. Counsel for the *Olympic* contended that this course was never set, and the *Hawke* was never upon it. Commander Blunt said he took this S. 74° E. course from the line of three buoys off Cowes which he could see in front of

him, viz., the West Conical, the Chequers, and the East Conical, and steered more especially by the Chequers, which was the outlying one, to pass clear, but as close to them as he could; and that following that course he passed about 20 yards off the Chequers, and about 30 yards off the others. There was another cruiser called the *Edgar* lying ahead anchored in Stokes Bay; and the man at the wheel was told to steady on the *Edgar*. Where a fixed object lies in or quite near a course, the helmsman is often in practice told to steady on such an object, not so much to steer for it as to have ready assistance to keep the ship's head steady.

The position where the *Edgar* was anchored was proved; and the bearing of the *Edgar* from the *Hawke* when the latter was off the Chequers Buoy was S. 73° E., which confirms the course said to have been set. Commander Blunt said he was absolutely certain about the course. His evidence was also that the *Olympic* was still on her turn when he steadied on the S. 74° E. Lieutenant Aylen testified to seeing that the course was S. 74° E. on the standard compass after the commander steadied her, and to hearing afterwards the order to the helmsman to steady on the *Edgar*, or steer for the *Edgar*. Lieutenant Bashford heard the order to steady on the *Edgar*—and saw that the vessel was in fact so steadied. Hunt, a quartermaster on the bridge, said he saw the *Hawke* steadied on S. 75° E.—this was by his steering compass—and heard the order, "Steady on the *Edgar*," and that he himself took the wheel by Lieutenant Bashford's direction and steadied the ship on the *Edgar*. So much for the evidence from the *Hawke* upon the question of this course.

How does the evidence from the *Olympic* fit in with this? The pilot in charge said that when the cruiser was about a quarter of a mile away on his starboard quarter, he saw that she had altered from her original course, *i. e.*, (N. 77° E.) and had got on No. 2 course. To quote his own words, "She was on No. 2 course then. I will call it E. by S." That is S. 78¾° E.—converging more upon S. 59° E., by 4¾° that S. 74° E. would be. Later he said that at that time she was heading towards him converging 1¼ points, which would be S. 75° E., and ultimately he stated in terms that the cruiser might have been heading upon a course of S. 74° E. His case upon this was that she afterwards ported and came on a parallel course with the *Olympic*. Upon the evidence for the *Hawke* and upon the testimony from the *Olympic's* pilot, I find that after turning Egypt Point, the *Hawke* was steadied on a course of S. 74° E.

We have now arrived at this: that after the two vessels were steadied upon the completion of the turnings, their courses were S. 59° E. and S. 74° E. respectively. They were, therefore, converging at an angle of 15 degrees, and if their courses were pursued, risk of collision was involved.

I stated before that the positions in the channel of the two lines of these courses were important and required careful investigation. They determine not only the respective parts of the channel to which each vessel got; but also in large measure the disputed point as to whether the *Hawke* subsequently ported herself into a parallel course.

The cases of the two vessels are contradictory. The *Olympic* alleged that the *Hawke* came much further north into the channel than a turn

round Egypt Point required or fitted. Captain Smith brought the *Hawke* up to a position (which he marked on a chart) about 6 cables and 130 yards north of Egypt Point; and the pilot brought her up about 8 cables and 160 yards to N.N.E. of the point. The allegation of the *Hawke* was that she rounded Egypt Point about 3½ cables off.

The *Olympic's* evidence was directed to prove that she was in a good mid-channel course when she steadied on S. 59° E., because she so steadied with No Man's Fort open on her starboard bow, 1, 2, or 3 degrees. The course recorded in the log was, as I have said, "West Bramble Point to Peel Buoy, S. 59° E." No Man's Fort was distant about 8½ miles; Peel Buoy was 3½ miles. Her course would have to be changed at the Peel Buoy, and at various other points long before reaching No Man's Fort. It could not be reached on that course. The vessel would have been on the banks before long.

It might have been that the helmsman was told to keep an eye on that well-known distant fixed object so as to help him to keep the head of his huge craft steady, but Helmsman Haine's story about this was very extraordinary. He did not mention No Man's Fort in his examination in chief, when he said what course he steered. In cross-examination he said: "When I got the order to steady, there was just the No Man's Fort on the starboard bow, 2 points." He insisted over and over again that the fort was "2 points" or "22 degrees" on the starboard bow. That, of course, was impossible, but such was the state of his mind upon it when his evidence was given.

I cannot accept the story that the course was fixed and kept upon a line showing No Man's Fort a little (up to 3 degrees) on the starboard bow. A few degrees at such a distance would make all the difference. A line with the fort 2 degrees on the starboard bow would bring the vessel quite close up to the Ryde Middle Shoal, and 3 degrees or more right on the shoal. Therefore, the exact line of the *Olympic's* course in the channel cannot properly be determined by considering angles between her and the fort.

The evidence from the cruiser was led to establish that she passed within 3½ cables of Egypt Point, and that her S. 74° E. course from there kept her on the extreme starboard side of the channel, and brought her as close as she could get to the three buoys already referred to.

All the officers who were called from the *Hawke* testified to this. Lieutenant Aylen observed the position at three places, at Solent Bank Buoy, Gurnard Ledge Buoy, and Egypt Point. He entered these, with the times, in a note book, which unfortunately, was lost overboard at the shock of the blow between the vessels when he stood in the chains on the side which struck. Lieutenant Aylen's honesty and integrity were not impeached. His evidence must, in the absence of the lost book, be considered as that of any other witness. If he is right in his recollection, he established the line on the N. 77° E. course as being about a cable inside the line of S. 77° W., which was, and is marked on what was called the impounded chart, and which I marked "F," and proves that Egypt Point was passed about 3½ cables off. If the course was set, as I have found

it was after the turn, and if it was set at about this distance off the point fixed by Lieutenant Aylen and others, and if it was followed up to and close along the line of the three buoys, then one is not surprised to hear, and one is naturally prepared to accept the evidence that Commander Blunt remarked to the navigator that the *Olympic* was coming unpleasantly close, and asking him when just past the Chequers Buoy, whether he could haul any more to the starboard, and that the reply given was: "Not till you are past the Red Buoy," meaning the East Conical Buoy, and that as soon as he could see the Old Castle Point Buoy clear of the Red Buoy, he gave the order to port which he said he gave.

Again, what is the evidence from the *Olympic* upon this? As to the position of the *Hawke* in coming up the Solent the pilot gave evidence. He said that when he blew the two-blast starboard helm signal to let the *Hawke* know that he was rounding the West Bramble, she was 1½ miles away from him right in mid-channel, abreast of Gurnard Bay, coming up on a mid-channel course of N. 77° E., and as near to East Lepe Buoy as she was to Gurnard Ledge Buoy. Now the distance between these two buoys is 6 cables. But if a line is drawn on a course of N. 77° E. from the spot where the pilot marked the *Hawke* when the *Olympic* steadied on her last course (even supposing that the *Hawke* had not before changed to a southward and eastward course) past the East Lepe Buoy, it would pass Egypt Point rather over 6½ cables away, but it would go within 30 or 40 yards of East Lepe Buoy and over 5½ cables away from the Gurnard Ledge Buoy. It would also go over the Solent Bank. The same can be said within 70 or 80 yards of a similar line drawn from the corresponding spot marked by Captain Smith. The evidence of the pilot on this point is nearer the truth than his marking on the chart, and is more consistent with that of Lieutenant Aylen as to the distance from the land of the *Hawke's* up-channel Solent course. Reference may also be made to the evidence of Mr. Lashmer, the master of the yacht *Belinda*. He described where his yacht was off Cowes, and said he saw the *Hawke* turn Egypt Point; he said he could see without any difficulty at what distance from the land the *Hawke* made the turn, and he gave the distance as 300 yards only.

For these reasons, amongst others, I find that the line of the S. 59° E. course of the *Olympic* was much further south than her witnesses stated; and that the line of the S. 74° E. course of the *Hawke* was substantially where it was stated to be by Commander Blunt and Lieutenant Aylen.

This conclusion is consistent with what I have found to be the true place of the collision. The explanation of the *Olympic* coming so far south is, I think, that the pilot with his huge vessel made too large a sweeping turn round the Brambles. What tide there was—half a knot—would also tend to set her to the south.

Now I must deal with the question of whether the *Hawke* was at any time the overtaking ship, and whether she is to be regarded as the overtaking ship at the time of the collision. Was she at any time coming up with the *Olympic* from a direction more than 2 points abaft her beam? In the course of his final address I asked Mr. Laing at what time the vessels

ceased to be crossing vessels, if they ever were crossing vessels; and at what time they became overtaking and overtaken vessels. His reply was that that raised a point which had to be considered with great care, that he was not sure of the exact answer he was going to give at the moment, as he had not considered it. But I assume from the way the evidence was placed before the court, that the *Olympic's* contention is that at any rate from the time when she was steadied on her S. 59° E. course the *Hawke* was the overtaking vessel and ought to have kept out of her way. Many witnesses deposed that at this time the *Hawke* was 2½ to 3 points on her starboard quarter and distant a quarter of a mile or more. They placed the *Hawke* therefore 5 to 5½ points abaft the beam of the *Olympic*, and said she was much the faster vessel until the *Olympic* came to pass the *Hawke* just before the accident. There was an extraordinary similarity, amounting almost to complete identity, about their evidence. Much reliance was placed upon it by counsel for the *Olympic;* and especially upon the testimony of Colonel Sexton White. This gentleman was a man who had experience of steam trials and who was pretty familiar with ships. He placed the *Hawke* at about a quarter of a mile (400 to 500 yards) away from the *Olympic* and on her starboard quarter. He had no practical knowledge of "points" of the sailor's compass; but when asked to show by models the relative positions of the two vessels, he placed the *Hawke* about 5½ points abaft the beam, on the starboard quarter of the *Olympic*. This body of evidence, if it could be relied upon as being the result of accurate and nautically intelligent observation, would be very important. But general observation as to the distances, bearings, and speeds of two vessels turning at different points, at a considerable distance away, about the same time, and then angling towards each other is difficult and liable to great errors. Evidence of that kind requires to be submitted to a careful test; and tests are available in this case. None of the observers at the time were thinking of any collision, and none of them made observations with reference to any fixed objects on the land or otherwise. They may have made mistakes, and harbored inaccurate impressions. Even Colonel White, who was perhaps the most trained and intelligent of the witnesses, was clearly mistaken as to the place of collision, and of the place where he described the *Hawke* to be when he said she starboarded into the *Olympic* just before striking her. Of such places he would be likely to take note, and indeed he noted them in this instance by reference to a fixed object on the land close by. He said that when the *Hawke* starboarded, she was rather to the eastward of Old Castle Point, and that the *Olympic* had got abeam of old Castle Point at that time. But the place of collision was in a direction not eastward but N.N.W. from this point, and on her course the *Olympic* would not have been abeam of the Point for another 750 yards beyond where she collided; or, to test the value of such observations in another way, she would not have been abeam of the Point for another half a mile beyond where Captain Smith said she collided. Other observations by the same body of witnesses produced upon them the impression apparently that the vessels were for a long time upon parallel courses, brought to the parallel, according to the pilot, by the *Hawke* porting from her S. 74° E. course.

The evidence, as has already been pointed out, established that the vessels were never brought on parallel courses at all. There are still safer tests of the accuracy of such observations, or impressions, which show that they are not reliable. It is capable of mathematical demonstration that if the ships were on converging courses of 15 degrees (which it has been shown they were) and the *Hawke* was a quarter of a mile away, and 5½ points abaft the beam of the *Olympic* (as most of the witnesses say), the *Hawke* would have to travel just about twice as fast as the *Olympic* in order to meet her at the point of intersection. I have found the speed of the *Hawke* to be 15 or 15¼ knots an hour, on evidence which appears to me to be unanswerable; accordingly the *Olympic* would only travel from where she was straightened on her course to the point of intersection at 7½ knots, or so, which is absurd.

Similarly, with the *Hawke* at 5 points abaft the beam, the ratio of speed to the *Olympic* would be as 11 to 6; that would give a speed to the *Olympic* to the point of intersection of about 8½ knots, which again is absurd.

Apply one other test. The distance between where Captain Smith marked the *Hawke* on the chart, 5½ points abaft the beam when his vessel steadied on her course to the place of collision is 1 mile and 3 cables. (The distance is the same to the place which the particulars chart delivered by the *Olympic* fixed for the collision.) According to the logged time of the *Olympic* the *Hawke* travelled this distance in 3 minutes; to do that would require a speed of 26 knots an hour upon the *Hawke*.

If a mean time of 3½ minutes is taken, her speed would have to be over 22¼ knots an hour.

And even if 4 minutes (which is outside the maximum) are given, her speed would have to be 19½ knots.

These speeds on the *Hawke* are impossible. These tests show conclusively, in my opinion, that the evidence of the impressions as to distance and bearing given by the witnesses referred to cannot be relied upon. The evidence given by Mr. Lashmar, Mr. Gaudion, and Captain Lee was of much the same character, and is open to the same criticism. Further, with regard to the two last-named witnesses, whose range of vision was limited as marked on the chart, it is to be observed that their eidence is quite consistent with what I have found to be the facts, that they should first see the *Olympic* come into sight, and then the *Hawke;* that the opening between the two should be closing to their vision, and that the *Hawke*, being so much nearer, should appear to them to be travelling at a faster rate. The comments upon their evidence which Mr. Aspinall made in his address, and which he illustrated by a diagram, are fair and sound.

It is upon such evidence of general observation as I have been dealing with that the *Olympic* founded her case that the *Hawke* was an overtaking vessel.

Commander Blunt denied that the *Hawke* ever was 2 points abaft the beam of the *Olympic*.

I have come to the conclusion that he is right.

The *Hawke* was *not* an overtaking vessel within the meaning of the rule. If either vessel was, it was the *Olympic*, which overtook the *Hawke*.

I think that in approaching the place where the vessels collided, they were crossing vessels, and, as the *Olympic* had the *Hawke* on her starboard side, she ought to have got out of the way.

From what has already been said about the lines of the courses in the channel, it follows that I cannot accept the version of the *Olympic* that the vessels were laterally apart a distance of 300 yards when the *Hawke* was said to turn on a starboard helm towards and into the *Olympic*.

According to the turning circles of the *Hawke*, if the vessels had been 300 yards away from each other laterally, she could have passed under the stern of the *Olympic*.

They were more like 100 yards apart when the *Hawke* swerved in.

I am asked to decide that the cruiser starboarded in order to get under the stern of the other vessel.

The case for the *Olympic* was that the *Hawke* executed a manœuver under a starboard helm in order to do this.

Even if the distance between them was about 300 yards, as alleged, the attempt would, to use the phrase of Captain Smith, be "an inconceivable manœuver." The commander, three officers, and two men at the wheel on the *Hawke* all denied positively that an order was given to starboard, or that the helm was starboarded. If the intervening lateral distance was something like 100 or 150 yards, the suggested manœuver would be still more inconceivable. To find that it was executed I should have to disbelieve these witnesses. About such a matter there could not be a mistake. The only alternative is that they swore falsely, and conspired to swear falsely. I cannot adopt that alternative. It is to be remembered in this regard, and indeed in regard to the whole of their evidence, that the officers of the cruiser gave their testimony at an inquiry, which was held the day after the accident. At that time it is quite improbable, if not impossible, that they could have any knowledge of the case which would be made on behalf of the *Olympic*, as to speeds, bearings, and so forth. It is not unfair in the circumstances to assume that the accounts they gave at this trial were the same as, or consistent with, those to which they testified at the inquiry. They must have known that their superior officers would carefully watch the evidence that they would give.

I now come to the circumstances which occurred immediately before the vessels came into collision.

When the *Hawke* was in a position to clear the East Conical Buoy an order was given to port her helm 5 degrees. This was done in order to give as much room as possible to the *Olympic*. The *Hawke* changed her heading to the south under this helm to the extent of less than a point. Suddenly, however, she swerved in towards the large vessel. Evidence was given by Mr. Taylor, a naval constructor in the U. S. Navy Department, on the theory of "Suction" or interaction between vessels, especially in shallow water—a subject to which he had given much study. Interesting experiments were also made in the presence of the Elder Brethren and myself. They were not very conclusive, especially as to the direction and extent of the forces, but they showed that disturbing forces were set up. In this case the speeds of the two vessels were high, and the

disparity between the displacements of the two vessels was enormous; they were roughly as 7 to 1; and they were in close proximity. Moreover, if the place of collision which I have accepted is substantially the correct one, it happened that just before the swerve the *Hawke* was passing over the shallowest part of a shoal, which would tend to give her a sheer towards deep water. The *Olympic* was at about the same time passing over a bottom which was irregular and of comparatively small depth.

I have decided that there was no starboarding by the *Hawke* as contended by the *Olympic*—and I am of opinion that in the exceptional conditions which prevailed, the forces set up in the water are sufficient to account for the *Hawke* being carried towards the *Olympic* in a swerve which was beyond her control.

The *Olympic* had ample room and water in the channel to the northward. She came much too close to the cruiser on the south side of the channel. She did not take the proper steps to keep out of the way. She might have averted the collision right up to the last if she had put her helm hard astarboard. Even when the pilot saw the *Hawke* come towards his vessel, he delayed action; and even when he took it, he ordered the helm hard aport, which was a very doubtful manœuver. In the agony of the situation, certain orders were given on the *Hawke*. They did not avail; but they were not wrong. In carrying them out the helm was jammed, but this was an accident for which no one is responsible, and which did not affect the collision.

I cannot find that the *Hawke* is to blame for not acting otherwise or earlier, because she had to keep her course and speed until it was clear that the collision could not be averted by the action of the *Olympic* alone, and, as I have said, action on the part of the *Olympic* at almost the last moment might have prevented the accident.

Complaint was made that the *Hawke* failed to give sound signals when rounding Egypt Point on a port helm, and at the last, when the commander ordered "port 5 degrees" in an attempt to get as far away from the *Olympic* as possible. These signals ought to have been given; but the omission to give them has nothing to do with the collision, and there is no presumption of fault in the case of the king's ship.

On the main issues raised, I therefore find upon the evidence; (1) That the *Olympic* has failed to establish her contention that the *Hawke* was an overtaking vessel bound to keep out of the way; (2) That the vessels were crossing vessels, and that the *Olympic* having the *Hawke* on her starboard side, should have kept out of the way of the *Hawke;* (3) That the *Hawke* was not to blame for what she did, or omitted to do; and (4) That the cause of the collision was the faulty navigation of the *Olympic* by her pilot in going dangerously near the *Hawke* and the non-observance of the rule which required her to keep out of the way.

I am not troubled in this case with the question of whether a breach by the *Olympic* of Article 19 of the Sea Regulations involved a statutory presumption of fault under section 419 (4) of the Merchant Shipping Act, 1894, because I am of opinion that the breach contributed to the accident. This question may have been decided inferentially in the "Sans

Pareil" (1900, p. 267), but upon that, having regard to the decision in the *Hero* (1911, p. —), under another rule, I do not express any view.

One other matter still remains for decision, viz., whether the owners of the *Olympic* are protected from the results of her faulty navigation by the defence of compulsory pilotage.

It was formally proved by the first witness at the trial that the *Olympic* was in charge of a duly licensed pilot in a compulsory pilotage district; that all the orders preceding the collision were given by the pilot; and that all his orders were properly and promptly obeyed. During the rest of the trial this matter was left untouched. It receded into the background, and seemed to have faded out of memory, until Mr. Aspinall, in his address in answer to Mr. Laing, dealt with it. The Elder Brethren and I were carefully watching to see whether it would be suggested to the witnesses for the *Olympic* that anyone other than the pilot was to blame. It was put forward in a vague sort of way by Mr. Aspinall, at the end of the case, that the pilot was not solely responsible for the accident: "Because he was navigating his ship upon an assumption of facts which did not exist, and he was not kept informed of the real facts." When asked who the persons were other than the pilot, whose negligence partly caused the accident, he said: "The people, I should say, who were on the bridge, or the look-out men." He referred to an answer of the pilot in which he said: "Of course, while I was taking the turn, I was certain that I should get round far ahead of her, so while I was making the manœuver round the West Bramble Buoy, I was not paying much attention to her."

Then Mr. Aspinall added: "That was all the pilot knew and no more, and if his view as to the place was entirely wrong, then he was not properly informed by the owners' servants as to what the real state of affairs was." Mr. Aspinall did not explain how the owners' servants, and which of them, could know that the pilot was not paying much attention to the cruiser, which was within his sight, and to which he had signaled; or how they, and which of them could know that the view of the pilot as to the place of the *Hawke* was wrong. Similarly, Mr. Bateson, to whom I allowed a final reply, said that his case was that neither the men looking out forward or the man looking out aft gave any information to the pilot, "and the pilot never knew, nobody on the bridge knew, that we were meeting on converging courses." I asked him if he alleged any fault on the part of Captain Smith; at first he answered; "It may be that Captain Smith was relying on the look-out man," but afterwards he said that he did allege some default on the part of Captain Smith. I then asked him: "Did you put any question to Captain Smith indicating that you were going to blame him so that he might have a chance of explaining?" Mr. Bateson's answer was: "I do not think there was any question directly put to him in that form, but he tells us what he did, and that was quite sufficient for us, when he told us himself what he did. He had not excused himself from telling the pilot what was going on. The fact was he did not know, he could not tell the pilot; he did not know." And finally he said: "The point is a want of information; the pilot was not kept informed of the real position of the *Hawke*. The pilot was the person who could and ought to have kept himself informed of this.

There is not a particle of evidence that the collision was caused partly by negligence of other persons for whose negligence the owners are liable.

It may be very desirable that the law as to the defence of compulsory pilotage should be altered. I have on previous occasions expressed my views as to that. I may add that the Departmental Committee appointed to consider the question unanimously recommended the abolition of the owners' immunity.

But it is for the legislature to make the law. My function is to declare and administer it as it now stands.

The authorities as to the existing law are clear. The collision here was due solely to the faulty navigation of the pilot, and there is not a shadow of foundation for saying that the negligence of any of the owners' servants partly caused it. The owners of the *Olympic* therefore succeed on the defence of compulsory pilotage.

I have now dealt with the whole case.

As it is one of great importance, I wish to say expressly that the Elder Brethren, who have given me assistance which I value highly, are in complete accord with all the findings which form the basis of this judgment.

The result is that the action against Commander Blunt fails, and he is entitled to judgment.

In the other action, although the collision was brought about by the negligent navigation of the *Olympic*, the pilot is solely responsible for that; and accordingly judgment must be entered for the owners of the *Olympic* upon the defence of compulsory pilotage.

NOTE.—The litigation arising out of the collision on September 20 last between the White Star liner *Olympic* and the British protected cruiser *Hawke* is not yet finished. At the first hearing the British Admiralty Court decided that the liner was entirely to blame, but that as her owners were compelled to carry a pilot through the waters in which the accident happened they were not liable to damages. The White Star Company has, however, decided to appear against the decision of the court, so that the whole affair is really still *sub judice*. Meantime, the British naval authorities have expressed their approval of everything done by the commander of the *Hawke* (William Frederick Blunt) by promoting him from the rank of commander to that of captain.—*Scientific American Supplement*, Feb. 24.

Absence Over Leave in the Fleet.

(SEE No. 140.)

COMMANDER W. A. EDGAR, U. S. Navy.—I agree with Captain Fullam in all but minor details, both as to the cause of the evil and the remedy for it.

I have used practically the same system of punishment on the three vessels I have commanded, having first tried it when I took command of the *Dolphin* in 1906. The system met with such success that I have carried it out ever since when in command and tried to induce my captain to adopt such a scheme when I was executive officer of a battleship.

I believe that restricting a man awaiting his term of confinement is unnecessary and unjust, as it is not his fault that the brig is not vacant, and that no man should be deprived of his regular liberty except for some unusual circumstance.

As for the punishment of extra duty on the quarter-deck under arms it seems to me that the object is better attained by giving real extra duty, dirty work below that always has to done by some one; it is more disagreeable without being mortifying.

I am of the opinion that such a system of liberty and punishment for breaking liberty as adopted by Captain Fullam would be of immense value to the navy if uniformly carried out on all vessels, the proper amount of loss of pay by sentence of deck courts or summary courts to be clearly defined and to be much heavier than prescribed by the present department schedule.

Cheaper Paint for the Navy.

(SEE No. 140.)

MR. MAXIMILIAN TOCH.—The article by Mr. Henry Williams of the navy on "Cheaper Paint for the Navy," deserves the closest attention of everybody connected with the paint industry and with the government.

It would appear from the information contained in this article that Mr. Williams is the first officer connected with the navy who has the courage of his convictions and his convictions are undoubtedly based upon scientific knowledge.

The writer has been familiar with the methods and the materials used in the United States Navy for the past 25 years, and to use a comparison which savors of a pun, the navy in its paint operations has been killing sparrows with ten-ton guns.

The paint materials that have been wasted on the battleships are legion, and it took a man of the strength and character of Mr. Williams to make the necessary inovations which, by the way, are only just begun, and, if carried through successfully will save the government a vast amount of money every year.

From present indications it looks as if Mr. Williams has saved the navy, during 1911, many thousands of dollars equal to a large multiple of the amount of his salary, and the unfortunate part of the whole thing is, that he probably will never get the credit that is due him, nor the recognition that is his desert, and when the improvements and innovations which he has inaugurated are found to be working in good order, it will probably be with him as with every other earnest and honest man, his name will not be mentioned in conjunction with the excellent work that he has done.

Enlightenment and scientific management seems to be the order of the day, and scientific paint making is coming into its own. The enormous amounts of white lead, zinc oxide, red lead and turpentine that have been mis-used and mis-applied are, let us hope, forever gone by, and Mr. Williams has clearly pointed out that paint should be made of materials which will do the work for which they are intended, and it is totally unnecessary to use materials which have no other recommendation beyond their excessive high price.

I must criticise only one statement made by Mr. Williams which is, the cost of red lead. It is nearer $3.00 than $2.00 per gallon at the present writing.

I am reliably informed, that through the use of turpentine substitutes by our navy, it has already been adopted by the English navy.

Mr. Williams deserves special mention on account of his exhaustive and successful work in ship's-bottom paints.

The Hydraulic Interaction between Passing Vessels, Called "Suction."

(SEE No. 140.)

LIEUT.-COMMANDER EARLE, U. S. Navy.—This article quotes examples in which both vessels are underway. It seems not improbable that such a suction exists when, in a tideway and narrow channel, a vessel passes another which is at anchor.

When leaving Queenstown harbor on June 27, 1911, the *Iowa* was, by nature of the channel, obliged to pass quite close to starboard of the Cunard steamer *Ivernia* at anchor in the channel and riding to a strong flood tide. This steamer was drawing much more water than usual, as she had some compartments filled due to striking Daunt Rock coming into port, and was then being pumped out gradually. As the *Iowa*, proceeding at nine knots, overlapped the stern of the *Ivernia*, it became necessary to stop both screws to pass over an anchor buoy, this not appreciably affecting her speed and, on starting ahead, her steering became very difficult. Full port helm was required to keep her bow away from the *Ivernia*. It is my recollection that the starboard screw was slowed also. In all events, the *Iowa* passed much closer than was intended. At the time this was attributed more to the supposedly poor steering of the quartermaster than to anything else. I had not then read Mr. Reeves' lecture, but now believe this was also a case of such suction as he describes, the tide acting in lieu of the motion of the other vessel.

PROFESSIONAL NOTES.

Prepared by LIEUT.-COMMANDER RALPH EARLE, U. S. Navy.

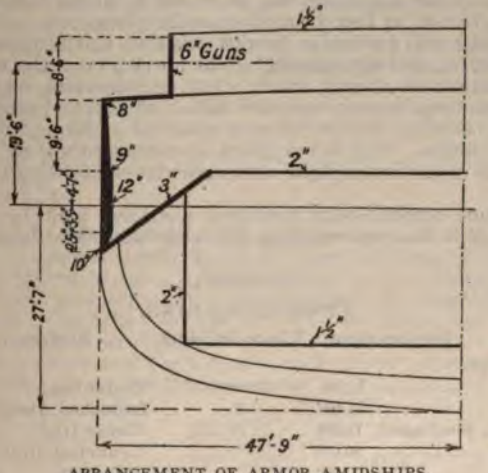
SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINE REPUBLIC.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Rivadavia	28,000	Fore River Shipbl'dg Co.	Launched Aug. 26, 1911.
Moreno	28,000	New York "	" Sept. 23, 1911.

THE ARGENTINE BATTLESHIPS "MORENO" AND "RIVADAVIA."—The arrangement of the armor amidships of the two Argentine battleships *Moreno* and *Rivadavia*, which are being built at the Fore River Yard, Quincy, in the United States, is shown herewith.



ARRANGEMENT OF ARMOR AMIDSHIPS.

The *Rivadavia* was laid down on May 25, 1910, and was launched on August 26 last. The displacement of the vessel is 28,000 tons in speed trial condition, and the corresponding draft is 27.7 feet. The other dimensions are: Length, 580 feet; breadth, 95 feet 6 inches; depth, 49 feet 7 inches.

The *Moreno* and *Rivadavia* are protected by a water-line belt of armor extending from stem to stern, the thicknesses of which are: 12 inches amidship, for a length of 250 feet and a depth of 4 feet 7 inches above

and 3 feet 5 inches below the water-line, tapered down to 10-inch thickness at a depth of 5 feet 10 inches below the water-line. Fore and aft of the main belt the thickness of the water-line belt is reduced to 10 inches as far as the foremost and aftermost 12-inch gun mounting, and from these points the thickness is 6 inches forward and 4 inches aft.

The citadel armor between the armored deck and the upper deck has a height of 9 feet 6 inches and a thickness of 9 inches below and 8 inches above the upper deck for a length of 400 feet amidships. The thickness of the armor forward and aft of these points is 6 inches and 4 inches respectively.

The casemate armor extends from the foremost 12-inch barbette to the aftermost barbette, and has a height of 8 feet 6 inches and a thickness of 6 inches. The forward conning-tower is 12 inches thick, the after tower 9 inches. The thickness of the protected deck is 2 inches on the horizontal part and 3 inches on slopes.

The armament is to consist of twelve 12-inch guns, twelve 6-inch guns, and twelve 4-inch guns.

The height of the main armament guns above the water-line is:

	ft.	in.
Foremost turret guns	31	8
Superposed turret guns, fore	39	9
Starboard turret guns, fore	31	8
Port turret guns, aft	31	8
Superposed turret guns, aft	31	8
Aftermost turret guns	22	5

The total weight of armor aggregates 7600 tons, 680 tons of which are employed for under-water protection against mines and torpedoes.

The bottom of the magazines are protected by armor and situated at a distance of 13 feet to 14 feet from the outside plating.

The battleships will be driven by three sets of Curtis turbines working on three propellers, and aggregating 40,000 horse-power, the corresponding speed being estimated at 22.5 knots. The fuel-carrying capacity is 4000 tons of coal and 660 tons of oil, the radius of action being 10,500 miles at a speed of 11 knots, 7200 miles at a speed of 15 knots, 3600 miles at a speed of 22.5 knots. The boiler plant is composed of 18 Babcock and Wilcox boilers in six water-tight compartments.—*The Engineer.*

The Argentine torpedo-boat destroyer *Cordoba*, built by Schichau, at Elbing, is stated to have exceeded 34 knots on her official trial.

AUSTRIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Radetsky	14,500	Trieste.	Under trial.
Zrinyi	14,500	"	Launched April 12, 1910.
Erzherzog Franz Ferdinand	14,500	"	Under trial.
Viribus Unitis	20,000	"	Launched June 24, 1911.
Tegetthof	20,000	"	Building.
VI	20,000	"	Authorized.
VII	20,000	Fiume.	"

BUDGET.—The total naval estimates for 1911 amount to approximately $25,000,000.

A new naval program has been adopted by the Austrian-Hungarian delegations, which authorizes the expenditures of $63,417,200 for shipbuilding, in six installments, during the years 1911 to 1916, inclusive. With this amount there are to be constructed four battleships, three cruisers, six destroyers, twelve torpedo-boats, and six submarines. Two of these

battleships were laid down in 1910, and contracts for the other two have been awarded. Of the remaining vessels of the new program some have already been ordered, and the others will be ordered shortly.

During 1911 there was completed the battleship *Zrinyi*, of 14,271 tons displacement.—*Army and Navy Register.*

DATA OF BATTLESHIPS.—The new Austrian *Dreadnoughts*, which were at one time the subject of a brisk controversy as to their raison d'être, are similar to their Italian rivals in that they carry their guns in triple turrets. The disposition, however, of the four turrets of the *Viribus Unitis* and her sister, the *Kaiser Franz Joseph*, is like that of the *Michigan*, and so even in this early stage of triple mountings there are examples of three different methods of disposing them. In the *Dante Alighieri* they are carried on the center-line all on the same level, and the *Ganguts* exemplify the échelon disposition. On a displacement of 20,000 tons the *Viribus Unitis* carries amidships, as in German ships, a secondary battery of twelve 5.9-inch, in addition to the heavy main battery of twelve 12-inch guns, which can deliver a broadside of nearly 12,000-pound weight. Parsons' turbines of 25,000 horse-power will drive the vessel at 20 knots, which is the same speed as the *Radetsky* class can maintain. A main belt of 12-inch nickel-chrome steel, tapering to 5 inches at the ends, gives adequate protection on the water-line, while the secondary battery is mounted behind 6-inch armor.—*Naval and Military Record.*

PROGRESS IN BUILDING.—The *Armeeblatt* of Vienna states that the battleship *Viribus Unitis* is making rapid progress at Trieste, and should be in commission next September. The sister ship *IV* is also advancing, and is to be launched in the spring. It is hoped that another ship, *V*, will shortly be laid down at Trieste. Active work is also proceeding at Malfoncone, where the cruiser *G* is to be launched in the first half of 1912. She is a sister of the *Admiral Spaun*. The very considerable works at Fiume are making progress, and it is hoped that one of the large berths will be ready for the laying down of the fourth *Dreadnought*, known as *VI*, in the first half of 1912. At the same yard the cruiser *H* has been laid down, and in the auxiliary yard at Porto Re six destroyers are to be built, of which three have been laid down and are well advanced. In the numeration of the battleships two pre-*Dreadnoughts* are included.—*Army and Navy Gazette.*

NEW BUDGET.—The estimates for 1912-13 carry a total of $28,318,500, an increase of approximately $3,500,000 over last year. The shipbuilding program, extending to 1916, is being carried out as planned.

Of the four battleships authorized one will be completed during the year, one will be launched shortly, one was laid down last December, and the fourth is to laid down immediately.

The three cruisers and the torpedo craft are all either under construction or ordered.—*Army and Navy Register.*

BRAZIL.

M. Geraes	(2)	19,250	23,500	=21	12 12-inch, 50 cal. 22 4.7 in.
Rio de Janeiro	(1)	28,000		=22	14 12-inch, 50 cal. 20 6 in., 12 12 pr.

Another navy which has become more important since the commencement of the *Dreadnought* era is that of the prosperous South American State of Brazil. She caused some stir by ordering from British firms two battleships of the *Minas Geraes* class, which at the time they were laid were the most powerful ships in the world. Since then she has ordered a third vessel, which was at one time to be of 32,000 tons, and designed to mount the hitherto unsurpassed armament of twelve 14.3-inch. How-

ever, on assuming office the new President caused the designs of this ship to be altered with a view to considerably reducing the tonnage, with the result that the *Rio de Janeiro*, as she is called, will only displace 28,000 tons. The caliber of the guns remains the same as in the first pair of ships, but, as stated in the South American supplement of *The Times*, she will carry no less than fourteen of these in seven twin turrets, an unprecedented number for one-caliber ships. For protection against destroyers, this powerful main armament is supplemented by a score of 6-inch weapons, and twelve 12-pounders. The *São Paolo* and *Minas Geraes*, which were laid down in 1907 by the firms of Armstrong's and Vickers' respectively, were completed in 1910, and are in every way worthy of British designers. Although of the same displacement as the *St. Vincent*, they were designed to carry two more heavy guns, so that the broadside amounts to ten guns, which, amongst the 12-inch-gunned ships of the British Navy, can only be equalled by the three *Neptunes*. Four turrets are mounted on the center-line in two pairs superposed fore and aft, the other two being mounted singly on each beam. The innovation of superposed turrets, which was first tested in these ships, results in an ahead and astern fire of eight guns, and, as stated in the description of United States ships, is of great utility in economizing length. A strong secondary armament of twenty-two 4.7-inch, somewhat akin to the American 5-inch batteries, is disposed for the most part on the main deck, the remaining eight being in well-protected positions in the superstructure. A feature is the armor protection, which, though thinner than usual on account of the heavy offensive equipment, is very complete and uniform in thickness. For instance, the whole of the side between the extreme turrets is covered with armor 9 inches thick, which ensures the safety of the secondary armament, which in contemporary British ships is exposed to considerable risk of destruction. With reciprocating engines of 23,500 horse-power both ships easily reached their designed speed of 21 knots, the *Minas Geraes* having steamed at a best speed of 22.29 knots, which is very creditable to the constructors.—*Naval and Military Record.*

CHILI.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Constitucion	27,500	Elswick.	Laid down Nov. 1911.
Libertad	27,500	Vickers.	" " Dec. 1911.

The first piece of the ram of the famous Chilean battleship *Constitucion* was put in place at Elswick in the second week of December. This vessel will have a displacement of approximately 28,000 tons. It should be launched early in 1913, and enter the service towards the middle of 1914.

This battleship and her sister will have ten 13.5-inch guns in main battery; and sixteen 6-inch guns in her torpedo-defence battery. They will be of 45,000 horse-power, have Parsons' turbines, and make a speed of 23 knots.

FRANCE.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Courbet	23,500	Lorient.	Launched Sept. 23, 1911.
Jean Bart	23,500	Brest	" Sept. 22, 1911.
France	23,500	St. Nazaire.	Building.
Paris	23,500	La Seyne.	"

BUDGET.—The total naval appropriations for 1911 amount to $80,371,-[illegible], as compared with $72,485,000 appropriated for 1910.

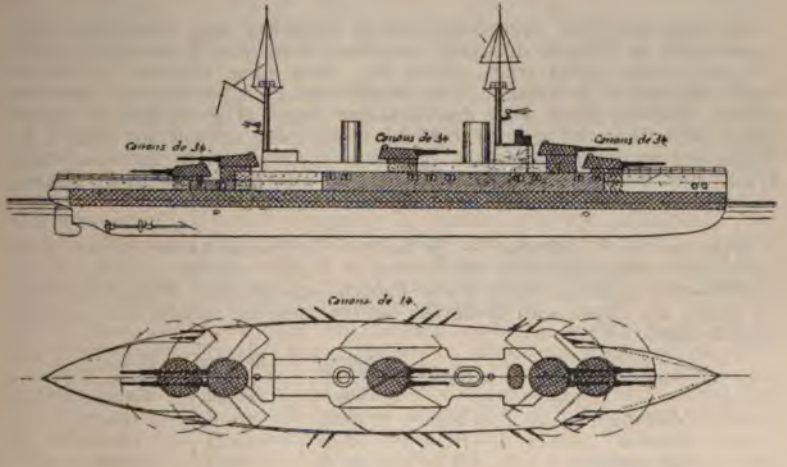
The shipbuilding program authorized for 1911 provides for the construction of two battleships, two submarines, and two mine-laying vessels. The battleships are to be similar to the *Courbet* and *Jean Bart*, authorized in 1910, of 23,100 tons displacement and a main battery of twelve 12-inch guns. The submarines are to have a submerged displacement of about 980 tons and a large steaming radius in order to be able to accompany the battle fleet.

Six battleships of the *Danton* class, 18,030 tons displacement, were completed during the year, as well as the armored cruiser *Waldeck Rousseau*, of 13,780 tons displacement. Seven destroyers of about 700 tons displacement and a number of submarines were also completed. Various experiments were made with the new submarine *Mariotte*, of 630 tons submerged displacement.

The naval estimates for 1912 have recently been submitted and amount to $82,364,302. The building program for 1912 consists of two battleships, nine submarines, and one transport.

According to press reports, the minister of marine has announced his intention of asking parliament to authorize the construction of a third battleship in order to make good the loss of the battleship *Liberte*, recently destroyed by magazine explosion.—*Army and Navy Register.*

THE BATTLESHIPS OF 1912.—A sketch of the two battleships, which the Navy Department will commence building in 1912, follows:



These battleships will have, like the *Jean Bart*, a displacement of 23,500 tons. The battery, however, will be different, and will consist of ten 13.6-inch guns mounted in five turrets, twenty-two 5.6-inch guns mounted in an armored casemate, and four under-water torpedo-tubes.—*Le Moniteur de la Flotte.*

The new French super-*Dreadnoughts* will, in their main batteries, be the equal of the English *Orion* and are superior in torpedo defence battery.

French	10 13.6-inch	22	5.6-inch
Orion	10 13.7-inch	16 to 20	4.1-inch

English constructors consider the armor belt of the French ships too far below water, and that it does not protect the decks from oblique fire.

The *Orions* are, however, in service three years ahead of these French ships.

THE NEW FRENCH BATTLESHIPS.—The *Moniteur de la Flotte* publishes a diagram showing the plan of the two battleships which the Ministry of Marine hopes to lay down in 1912. The design resembles in many ways that of the *Jean Bart* and *Courbet*, but there is an an important change in the matter of armament. Instead of twelve 12-inch guns, the ships will mount ten of 13.4-inch, all in double turrets on the middle line. The guns forward and abaft will be mounted as in the earlier ships, and will have about the same arc of training, being some 135 degrees, and probably a little more for the upper guns. Amidships, instead of two turrets on either broadside, will be one on the middle line mounting two of the new guns, and having an arc of fire of perhaps 100 degrees on the broadsides. There will also be twenty-two 5.5-inch guns mounted as in the other ships. The displacement will be about the same, namely, 23,500 tons. There have been labor troubles both at Lorient and Brest, and at the latter port electric wires were cut in the *Jean Bart*, whereby it appears some men were injured. The *France* has been put in hand at Lorient, and the *Paris* at the Chantiers de la Seyne, Toulon.—*The United Service Gazette.*

THE "PARIS."—The keel of the battleship *Paris* was laid at La Seyne, Toulon, on November 30, but material for her construction had been collected in anticipation. It is expected that the ship will be launched in October, 1912. She has been built on a masonry and cement slip specially constructed, and suitable for the building of ships up to a launching weight of 10,000 tons.

BATTLESHIPS.—The French battleships *Mirabeau* and *Vergniaud*, built respectively at l'Orient dockyard Bordeaux, have just completed a series of comparative boiler trials, which may have some influence on future naval machinery in France. The former vessel is fitted with Belleville boilers, and the latter with the Niclausse type. A good deal of uncertainty prevails in the navy as to which is the more suitable for large warships, and many engineers are agitating for a return to the small tube type, which was fitted in some of the earlier vessels, notably in the *Jeanne d'Arc, Chateaurenault*, and *Montcalm.—The Engineer.*

SPEED OF THE "DANTONS."—The belated *Vergniaud* having at last completed her acceptance trials off Toulon, it is now possible to compare the speed performances of the six new French battleships of 18,400 tons, three of which are fitted with Belleville boilers and the others with the Niclausse type:

Ships.	Boilers.	3-hour trial. Knots.	10-hour trial. Knots.	24-hour trial. Knots.
Voltaire	(B.)	20.66	19.78	18.63
Danton	(B.)	20.18	19.44	18.16
Mirabeau	(B.)	20.18	19.73	18.27
Diderot	(N.)	19.9	19.48	18.4
Condorcet	(N.)	19.7	19.31	18.02
Vergniaud	(N.)	19.63	19.2	17.74

As only 19.25 knots at full power and 17.5 for 24 hours had been stipulated, the results obtained must be pronounced satisfactory, all the more so as the *Dantons* proved, during the summer maneuvers, their aptitude for easy steaming at 17 and 17.5 knots. The ships fitted with Belleville's have been specially successful, the *Voltaire*, for instance, developing up to 29,657 horse-power, and reaching 21.2 knots. These performances afford good ground for hope that the *Bart* (Belleville) and *Courbet* (Niclausse boilers), now completing, will substantially exceed their stipulated speed of 20 knots, and rival the German *Helgolands* that have just done from 21 to 22 knots.—*Naval and Military Record.*

THE FRENCH DESTROYER "BOUCLIER."—The French destroyer *Bouclier* was recently handed over to the French Admiralty by the firm of A. Normand & Co., which built her. This vessel is the first among the numerous craft built at the Normand yard to be fitted with Normand boilers fired only with liquid fuel. The burners employed are of a type patented by the firm. The *Bouclier*, which was engined by the Cie. Electro Mécanique, of Le Bourget, near Paris, has the following particulars:

	ft.	in.
Length over all	233	4
Length between perpendiculars	23	4
Extreme breadth outside plating	24	10
Depth	16	5
Mean draft	12	6
Displacement on trials	660.44 tons.	

The hull is of high tensile steel, galvanized in the upper works. It is divided into ten water-tight compartments. The hull is clincher riveted, the stem is of forged steel, and the sternpost, etc., of cast steel. The vessel is divided as follows: From forward aft: Collision compartment, crew's quarters with chain locker underneath, ammunition room and store-room, boiler-rooms, engine-rooms, officers' quarters, petty officers' quarters, and store-room. The deck is covered with linoleum and wooden battens.

The *Bouclier* has a high freeboard forward, and owing to this the men are better berthed than in other French destroyers, while the vessel is able to maintain a good speed even in a rough sea. The navigating officer and the man at the wheel are also better protected than is the case in previous boats.

Steam is supplied to the main engines and auxiliaries by four Normand water-tube boilers. The liquid fuel is, before being used, heated in a form of heater which has been newly patented by the Normand firm. The boilers have a heating surface of 5277 square feet and a combustion chamber of 386 cubic feet capacity. The safety valves are set at 228 pounds per square inch, and at full power an air pressure equal to that of 110 mm.—about 4 inches of water—is permitted in the stoke-hold. The boilers have been designed each to burn 3300 kilos (=7273 pounds of fuel) per hour, but as a matter of fact this consumption was not reached during the trials even at full power when the speed attained was actually about 4⅓ knots in excess of that contracted for.

The main engines consist of Parsons' turbines driving three shafts. There are a high-pressure ahead turbine on the center shaft and two low-pressure ahead turbines on the wing shafts. Astern turbines are incorporated in the casings of the two latter turbines. Each shaft carries one propeller, 5 feet 3 inches in diameter and 4 feet 11 inches pitch, designed to work at 1000 revolutions per minute at full power. The condensers have a cooling surface of 11,682 square feet, and a vacuum of 700 mm. was guaranteed. The four Normand boilers have a heating surface of 21,108 square feet, and the cubic capacity of the furnaces is 1544 cubic feet. Each boiler has nine burners.

The following are the results of the official trials:

Six Hours' Full-power Trial.

Displacement at start	650.44 tons
Average mean steam pressure	217 lb.
Average mean steam-chest pressure	183 lb.
Average air pressure in stokeholds	109 mm.
Pressure in liquid fuel burners	143 lb. per square inch
Revolutions per minute, mean	1034.2
Mean speed for six hours	35.334 knots
Contract speed	31.0 knots

Six Hours' Full-power Trial.—Continued.

Shaft horse-power	15,000
Vacuum at condenser	700 mm.
Consumption of fuel per hour	21,912 lb.
Consumption permitted by contract	29,193 lb.
Consumption per square foot of heating surface	1.038 lb.
Consumption per horse-power hour	1.46 lb.

Eight Hours' Consumption Trial.

Displacement before trials	659.446 tons
Mean draft	1 .6 ft.
Mean steam pressure at boilers	2.4 lb.
Revolutions per minute, mean	325.19
Mean speed for eight hours	14.06
Mean speed as per contract	14.00
Shaft horse-power	1400
Vacuum at condensers	730.3 mm.
Consumption of fuel per hour	1915 lb.
Consumption of fuel per horse-power hour	1.37 lb. (nearly)

The shaft horse-power was ascertained by means of a Hopkinson-Tring tortiometer.

The *Bouclier* has up to the time of writing proved herself to be the speediest and most economical vessel of her class, and her performances are certainly excellent. Her armament consists of four 18-inch torpedo-tubes. Six torpedoes are carried. There are two 4-inch quick-firing guns, one forward and one aft, and two 2.5 quick-firers, two forward and two aft, one on each side. Four hundred and fifty shells are provided for each gun.

The fuel-bunker capacity is of such dimensions that the fuel which can be carried permits of a radius of action at 14 knots of 1950 miles.—*The Engineer.*

SUBMARINES.—The only new particulars which appear in the annex as to vessels to be constructed in the dockyards concern the submarines, which are to be designated *Q 94* to *Q 101*. With the exception of the last, all will displace 410 tons, and will be 181 feet long, with 16 feet 9-inch beam; they will have 1300 horse-power, a speed on the surface of 15 knots, and a complement of three officers and 24 men. *Q 102* will be a little larger, the intended displacement being 520 tons, the length 196 feet 9 inches, the beam 17 feet 9 inches, the surface speed 17½ knots, and the complement numbering two additional men. The *Gustave Zédé* and *Néréide*, which are under construction, are larger vessels—797 tons, 4800 horse-power, and 20 knots on the surface.—*Army and Navy Gazette.*

On September 22 there was launched at St. Nazaire a submarine salvage vessel for the French Navy. This vessel is 328 feet long, 87 feet 3 inches in extreme width, and displaces 1500 tons. For the greater part of its length the hull is divided into two parts, with a space of 42 feet 8 inches between them, and over this are erected ten girders with the necessary electrically operated machinery for raising a submarine up to 1000 tons. A very serious drawback to the vessel's utility is that she will have no motive power, and will thus be exceedingly difficult to manage in a sea-way.—*Journal of the Royal Artillery.*

PROGRAM FOR 1912.—The budget recently submitted to parliament carries a total appropriation of $88,364,302 and provides for laying down two battleships, nine submarines, and one transport. It is likely that a proposal to authorize a third battleship, to replace the *Liberte*, will meet with favorable consideration.—*Army and Navy Register.*

GERMANY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Oldenburg	22,400	Danzig (Schichau).	Launched June 30, 1910.
Kaiser	24,000	Kiel (Kaiserliche W.).	" Mar. 22, 1911.
Friedrich der Grosse	24,000	Hamburg (Vulkan).	" June 10, 1911.
Kaiserin	24,000	Kiel (Howaldt).	" Nov. 11, 1911
König Albert	24,000	Danzig (Schichau).	Building.
Prince Regent Luitpold	——	Germania Works.	"
Ersatz K. Friedrich Wilhelm	——	Hamburg (Vulkan).	"
" Weissenburg	——	Bremen (Weser).	"
" S	——	Wilhelmshaven.	"
Armored Cruisers.			
Goeben	22,600	H'b'rg (Blohm & Voss).	Launched Mar. 28, 1911.
J	25,000	"	Building.
K	25,000	"	Authorized.
Protected Cruisers.			
Breslau	4,500	Stettin (Vulkan).	Launched May 16, 1911.
Magdeburg	4,500	Bremen (Weser).	" May 13, 1911.
Stralsund	4,500	Bremen (Weser).	" Nov. 4, 1911.
Ersatz Strassburg	4,500	Wilhelmshaven.	" Aug. 24, 1911.
" Seeadler	4,500	Germania Works.	Building.
" Geier	4,500	Howaldt.	"

THE GERMAN NAVY ESTIMATES.—These have now been published in the *German Press,* and show that provision has been made for the second installment of the cost of three battleships and one cruiser which belong to the financial year 1911, for the third installment of the cost of three battleships and one cruiser which belong to the 1910 financial year, and for the fourth installment of the cost of three battleships and one cruiser which belong to the financial year 1909. The program for which a first installment is to be provided in 1912 includes one battleship, the *Ersatz Brandenburg,* and one cruiser, the *Ersatz Kaiserin Augusta.* Provision is also made for two small cruisers, and for the first installment of the cost of a torpedo-boat flotilla. The sum for submarines remains the same as last year—*i. e.,* £750,000. A sum of £150,000 will be provided towards the cost of the new Admiralty building, Berlin. For keeping the ships in commission a sum of £175,850 in excess of last years' amount is provided, an excess which is said to be due to a more extensive commissioning of large units; this leads also to an excess of £118,150 in the provision for ammunition as compared with last year.

The total naval estimates for 1911-12 amount to $107,232,000, as compared with $106,320,000 for the preceding year.

The naval appropriation bill for 1911-12 authorized the following new construction: Three battleships, one armored cruiser, two scout cruisers, 12 torpedo-boat destroyers, three surveying vessels, and $3,570,000 for submarine-boat construction and experiments.

During the year 1911 there were completed the battleships *Ostfriesland, Helgoland,* and *Thuringen,* having a displacement of 22,440 tons and carrying twelve 12-inch guns; also the armored cruiser *Moltke,* of 22,640 tons displacement and carrying ten 11-inch guns.

DATA ON GERMAN BATTLESHIPS.—The following table gives the classes and principal features of German battleships and armored cruisers de-

signed so far. The figure in brackets after each name indicates the number of vessels belonging to that class:

GERMANY

	Tonnage	Designed I. H. P. Speed	Armament	Broadside (pounds)
BATTLESHIPS—				
Nassau.....(4)	18,500	20,000=19.5	12 11-in., cal. 12 5.9-in., 16 24-pr.	6,080
Helgoland...(4)	22,800	25,000=20	12 12.2-in., 45 cal. 14 5.9-in., 14 24-pr.	7,848
Kaiser.....(4)	24,000 (?)	27,000=20	12 12.2-in., 45 cal., 14 5.9-in., 14 24-pr.	11,772
Ersatz Odin..(4)	25,000 (?)		10 14-in.	
ARMORED CRUISERS—				
Von der Tann (1)	19,000	44,000=25	8 11-in., 45 cal., 10 5.9-in., 16 24 pr.	6,080
Moltke.....(3)	23,000	50,000=25.5	10 11-in., 45 cal., 12 5.9-in., 12 24-pr.	7,600
"K".....(1)	(?)	90,000(?)=28	8 14-in.	

German battleships are now divided into classes of four each, and at present there are sixteen *Dreadnought* battleships completed, under construction, or preparing to build. In spite of the large armament of the first eight ships of the *Nassau* and *Helgoland* types, it is true that out of twelve heavy guns, only eight can be brought to bear on each broadside. In the *Nassaus* the 11-inch 45-caliber weapons are mounted in six turrets, one forward and one aft and four at the corners of the superstructure. Thus the ahead and astern fire is from six guns, and if attacked on both sides at once these ships would be able to reply with six guns on each broadside, which is very satisfactory—provided that the enemy obliges by making such an attack.

Associated with the heavy main armaments, these ships, like all the German *Dreadnoughts*, carry a battery of 5.9-inch quick-firers on the main deck behind armor, the *Nassaus* mounting ten, and the *Helgolands* twelve. In addition, for beating off destroyers there are sixteen 24-pounders, disposed in pairs in the superstructures, and on the main deck forward and aft, in the *Nassau* class; two less in the *Helgolands*. The displacement of the *Nassau* and her three sisters is 18,500 tons; their length is only 470 feet, but the beam—characteristic of German *Dreadnought* battleships—is as large as 89 feet. That of the *Helgoland* is 93½ feet, and the increase of length is 76 feet, the resulting large displacement of 22,800 tons being necessary to carry the armament of 12.2-inch guns with which these ships are equipped. These guns fire a heavy shell of 981 pounds with much the same degree of penetration as the British 50-caliber 12-inch. They will probably be superseded in the *Ersatz Odin* and later ships by the new 14-inch weapon, and so only one division of eight ships will be armed with them. The *Kaiser* class, of which two have already been launched this year, will almost certainly have their guns disposed in five turrets, as in the *Neptune* and *Moltke*. There is some doubt as to whether there will be ten or twelve, but it is possible that the forward and aft turrets will be triple, enabling twelve guns to be mounted as in previous ships. This disposition is most praiseworthy, as one of the objections to 12-gun ships has been overcome by having only five turrets, and so avoiding undue interference. Again, the employment of the triple turret, which presents a large target and if disabled involves a considerable loss of offensive power, is not overdone to the extent of some foreign designs. The *Kaiser* class, which displaces about 24,000 tons, are credited with the same secondary and mosquito armaments as the *Helgolands*. Moreover, the fourteen 5.9-inch of the main-deck battery appear to be somewhat higher above the water than in previous ships, and so less likely to be made unserviceable in a seaway. The design of the first ships to mount the

14-inch gun shows that the ten guns are apparently disposed in two triple and two twin turrets, arranged as in the *Michigan*, with the latter naturally superposed. Included in the armament, however, in addition to the main-deck battery of twelve 5.9-inch, is a medium armament of eight 8.2-inch in four twin turrets at the corners of the superstructure. It is difficult to see the reasons for the adoption of these weapons. Presumably they are intended for the attack of armored ships, as at 5000 yards the 8.2-inch of 45 calibers can penetrate about 9 inches of Krupp armor, and at longer battle ranges they might, with their comparatively rapid rate of fire, be effective against lightly protected armored cruisers. Their use against large destroyers seems unnecessary owing to the presence on the same ship of quick-firing 5.9-inch of much greater handiness.

The German battleship-cruisers are of three types, and so far those completed or under construction number five. The *Von der Tann* is in a class by herself, and is a fine vessel of 19,000 tons and 28 knots trial speed, carrying an armament of eight 11-inch 45-caliber and a secondary battery of ten 5.9-inch, supplemented by sixteen 24-pounders, mounted as in the *Nassau* class of battleships. Her main armament is arranged like that of the *Indefatigable*, but the starboard turret is écheloned forward, instead of the port turret as in that ship; the only criticism against the German ship is that the main-deck battery is too near the water, a defect which could have been remedied by prolonging the forecastle deck as far aft as the port turret, and so having three out of the four turrets on the same level. In the design of the *Moltke* and her two splendid sister ships, the *Goeben* and *J*, which has only lately been begun at Hamburg, the design is much improved. The ten 11-inch are arranged so that the additional turret fires over the stern guns, four of the turrets being on the level of the forecastle, so that the dozen 5.9-inch of the secondary battery are well clear of the water. The four 24-pounders carried in the *Von der Tann* on the main deck astern have in these ships been suppressed, leaving only twelve. The design of the 14-inch-gunned cruiser *K* is similar to that of the battleships which mount the new gun, with the exception that all four turrets are twin mountings. As in the *Ersatz Odin* class, the 8.2-inch appears, and the customary battery of 24-pounders is abandoned. It is noteworthy that in the interests of homogeneity the 12.2-inch has not been adopted for armored cruisers.—*Naval and Military Record.*

NEW BATTLESHIPS.—The German battleship *Ersatz Hagen*, laid down in November, 1910, was launched at the Howaldt yard, Kiel, on November 11. The vessel was named *Kaiserin*, and will form a homogeneous group with the *Kaiser*, *Friedrich der Grosse*, and *Konig Albert* (*Ersatz Aegir*).

Orders for the German armored ships of the 1911 program have been placed, but there is as yet no information as to the date of laying down. One battleship will be built at Wilhelmshaven, at the Weser yard, Bremen, and at the Vulcan yard, Hamburg; while the cruiser *K* will be built by Messrs. Blohm & Voss, at Hamburg. The last-named firm has built all Germany's cruiser-battleships and seven of the thirteen armored cruisers built and building.—*Journal of the Royal Artillery.*

DELIVERY OF SHIPS.—The ships of the program of 1909 to be delivered in 1912 are three battleships: the *Oldenburg*, the *Kaiser*, the *Friedrich der Grosse;* the cruiser-battleship *Goebin*, and two small cruisers, *Breslau* and *Magdeburg*. During the year 1911, five ships were delivered the last being the *Moltke*.

RESULTS OF SPEED RUNS.—The battleship Helgoland has proved to be the fastest in the fleet. She has maintained a speed of 22 knots, while her sister ships, the *Thüringen* and *Ost Friesland*, have done 21.1 and 21.3 respectively.

The cruiser-battleship *Moltke*, fitted with Parsons' turbines, made, over the measured mile at Danzig, a speed of 29.7 knots.

NEW BRITISH AND GERMAN BATTLESHIP CRUISERS—"LION" AND "MOLTKE."—To compare the *Lion* with the *Moltke* is very much like drawing a comparison between the *Dreadnought* and *Lord Nelson*—the ships are contemporaries only in name, and really belong to two different eras of warship design. That this should be the case reflects both credit upon our construction staff and saddles the Wilhelmstrasse authorities with distinction of a somewhat opposite order, for while the *Lion* may be regarded as a cruiser edition of the *Orion*, the *Moltke* is more or less related to the *Neptune* class which preceded the 13.5-inch gunned ships, and is more comparable to the *Indefatigable*.

Both ships are, however, entering into service about the same date, and as examples of the latest work in battle-cruisers on both sides of the North Sea, make a comparison reasonable.

In design the ships represent totally different schools of thought, for whereas the British ship carries all her guns along the center-line and mounts 13.5-inch and 4-inch guns, her German "opposite number" follows the *en echelon* example of distribution—now almost universally abandoned—plus center-line, and carries 11-inch, 5.9-inch and 3.4-inch pieces. The pros and cons of each can best be discussed separately, and we will therefore first examine the characteristic features of the *Lion*.

The general outline of the ship can be seen from the plan and illustration. She is an *Orion* with the super-firing guns aft sacrificed, and her protection decreased for the gain of probably eight knots in speed. In order to accommodate the immense engine and boiler power her dimensions show a great increase over previous battle-cruisers, being: Length over all, 720 feet; beam, 88½ feet; and draft, 27 feet; giving her a displacement of 26,360 tons against the 18,750 tons of the 580 feet × 80 feet × 26½ feet *Indefatigable*. Her main armament consists of eight 13.5-inch guns, those in the second turret forward firing over the first pair, with a couple amidships, and also upon a lower deck level aft. These immense guns fire a 1250-pound projectile with a muzzle velocity of 2821 foot-second, and exert an energy of 69,000 foot-tons, are 45 calibers in length and weigh 76 tons. Her total weight of discharge compared with *Moltke's* works out as follows:

Guns.	*Lion.*	*Moltke.*
Ahead	4 13.5-inch = 5,000 lbs.	6 11-inch = 4,560 lbs.
Astern	2 13.5-inch = 2,500 lbs.	8 11-inch = 6,080 lbs.
Broadside	8 13.5-inch = 10,000 lbs.	10 11-inch = 7,600 lbs.

which gives the German ship a superiority when fighting astern only, while the advantage of greatly increased range and localized smashing power is with the *Lion*.

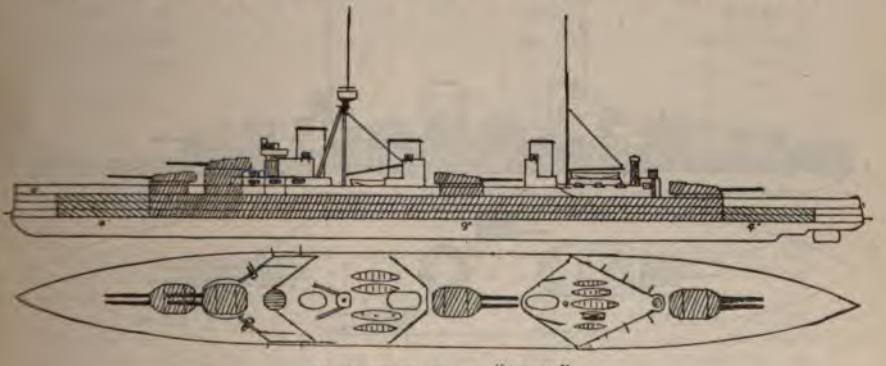
The disposition of the *Lion's* guns is perhaps not the best that might have been adopted. The amidship guns certainly have wide angles of fire, but by bringing them aft as in the Japanese *Kongo*, the concentration in the astern axial line could have been increased. This alternate arrangement is the one which has probably been utilized in the *Queen Mary* class.

The structures around the funnels are 2-inch blast-screens, which are designed to protect them from the firing effects of this pair of guns, and, from the angle at which they are set, to deflect small projectiles which might otherwise hole the uptakes, and so reduce speed, and enveloping the decks with smoke, make gun-setting difficult. Being clear of the quick-firing guns they have also been fitted to carry searchlights, the old idea of grouping guns and projectors on to bridges, etc., having been discarded in favor of keeping the latter well away from the shock and smoke of the 4-inch quick-firing pieces.

The anti-torpedo-boat armament of the *Lion* consists of sixteen 4-inch guns, firing a 31-pound projectile. Eight of these are up forward in the superstructure, and eight aft along the boat-deck, being so arranged that a good fire can be brought to bear on any given quarter. Compared with

the *Moltke's* secondary batteries of twelve 5.9-inch and twelve 3.4-inch weapons, the *Lion* appears undergunned as regards this portion of her equipment, and apart from any official assurances to the contrary, we have always regarded the secondary armament of our *Dreadnoughts* as their most unsatisfactory feature.

The *Lion's* 4-inch guns are unprotected except by thin screens and will obviously be all put out of action during the first half-hour of big-gun engagement, leaving the ship defenceless against the torpedo attack during the night following—a course adopted by the Japanese with the most disastrous results to the remnants of the Russian fleet which remained after Tsushima. It may, therefore, be argued that unless secondary guns are going to be protected by armor sufficiently thick to keep out the biggest projectiles, they may as well remain unprotected, medium plates such as the *Moltke* carries along her main deck being very little better than our own shields. This must be granted, and the question therefore arises "what constitutes an efficient secondary armament and how can it be economically protected?" If destroyers had not grown to the size of small cruisers, the 4-inch gun carried on a disappearing mounting so that it could be stowed away during action in an armored tube running down to behind thick armor would have been sufficient. But in these days of



PLAN OF H. M. S. "LION."

1000-ton boats, a 5-inch or 6-inch gun seems the only practicable defence, and these must be so disposed that the normal armor of the main or upper decks can be utilized to protect them, and this must have a thickness of at least 9 inches to 10 inches. That some such arrangement will be embodied in the ships of the forthcoming estimates is practically certain.

At the time of writing the *Lion* has not yet been on trial, so that the palm of being the fastest large ship afloat must be retained by the *Moltke pro tem*, she having reached 29.5 knots on trial. That the British ship will reach 30 seems taken for granted, and with engines of 70,000 horse-power capable of developing probably 100,000, it is more than likely that the German figures will be substantially improved upon.

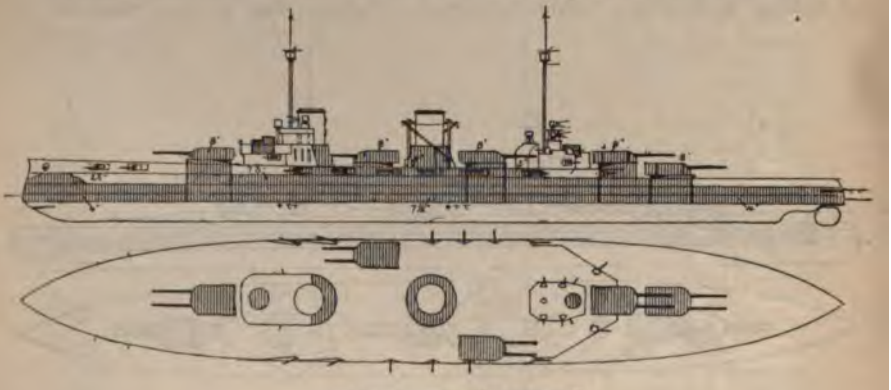
Great secrecy has been maintained over the protection and armor distribution, so that the following figures cannot be regarded as absolutely "officially" correct, although given by the most recent text-books. The main belt extends to about 20 feet of the extremities and has a maximum thickness of 9¾ inches, while the strake along the lower deck side is 7 inches—8 inches amidships, both belts tapering fore and aft to 4 inches. The entry forward is so fine that the continuation of the belt right up to the bow would have imposed too much strain on the structure; the hull is therefore subdivided fore and aft into many water-tight cellulose compartments constituting a thoroughly efficient substitute for the armor. The big gun turrets have 10-inch protection, and a 3-inch deck encloses the vitals of the ship.

In appearance the *Lion* is quite distinct from any other ship afloat. Her three funnels are all of different dimensions, the foremost being raised well above the bridge, while the third, although of the same height as the second, is thinner and rounded instead of oblong.

The water-tight aerials are suspended from the flying topmast of the tripod to the pole mast aft. Unlike the *Orion* there is no armor wall round the boats, although amidships they are partially stowed behind the funnel screens.

The *Lion* was laid down at Devonport on November 29, 1909, and launched on August 6 the following year. Her sister, the *Princess Royal*, was commenced at Barrow on May 2, 1910, launched on April 29, 1911, and is now completing for sea. The machinery (Parsons') for both ships was supplied by Messrs. Vickers.

The *Moltke* is an enlarged *Von der Tann*, with an extra pair of 11-inch guns aft, a couple more 5.9-inch in the battery, a higher free-board amidships, and some two knots more speed. Her design opens up a wide field for conjecture, for the retention of the *en echelon* placing of the second and third turrets is contrary to the general trend of gun distribution. If



PLAN OF THE "MOLTKE."

the idea finds so much favor, why was it not adopted for the *Helgoland* class? The most probable explanation is that some attempt at homogeneity with the *Von der Tann* was sought after, so that that ship, with the *Moltke* and *Goeben*, should form a tactical unit, an excuse, also, for the mounting of 11-inch instead of 12-inch guns. Whatever may have been the reasons that led to the construction of two ships carrying a main armament of 11-inch guns when rivals were putting 13.5-inch into their ships, the fact remains that the German Navy will have no battle-cruisers capable of tackling the *Lion* for some years to come.

The dimensions of the *Moltke* are as follows: Length 610 feet, beam 96¾ feet (the widest that has yet been given a warship), and draft 27 feet, giving a displacement of 22,632 tons. Her five turrets are placed: one forward, on the forecastle, two *en echelon* amidships, the starboard being the foremost, and two astern, super-firing—an arrangement practically identical to that of the *Neptune*. The twelve 5.9-inch are disposed along the main deck, the grouping on the two sides being two forward of the starboard turret and four abaft it, and five forward and one abaft the port. These are behind 5-inch armor. The twelve 3.4-inch are carried in the bows and on the two superstructures, one being placed just below the super-imposed turret. Incidentally, this gun does not show up well in current photographs of the ship, but the port is quite a large one, and

when the writer inspected the ship at Hamburg last July, the first impression was to regard it as a 5.9-inch emplacement, and credit the *Moltke* with fourteen of these guns. These 3.4-inch throw a 24-pound projectile at the rate of twelve a minute, and although mounted to repel anti-torpedo-boat attack, will probably be of little use except against small craft.

With a designed horse-power of 50,000, the *Moltke* has already reached over 29.5 knots, her power having worked up to somewhere in the region of 85,000 horse-power. Her lines are particularly fine despite her huge beam, the bow flare being very pronounced. It will be noted that the 3.4-inch guns there are not sponsoned as in *Von der Tann*, an amelioration that has improved the "dryness" forward.

Details of her protection can be gathered from the plan. The belt is 7½ to 8-inch amidships, tapering to 4-inch bow and stern, the lower deck side 5 inches and battery ditto, while the turrets have 8-inch walls.

A prominent feature of the ship is her immense funnels, with their wide, sloping bases—probably armored, although details on this point are lacking. Like the new battleships, she carries torpedo-nets along the main deck.

The *Moltke* was laid down in April, 1909, launched April 7, 1910, and is now entering service. Comparative features as as follows:

	Lion.	*Moltke*
Displacement	26,360 tons	22,632 tons
Torpedo-tubes	5 21-in	4 19.5-in.
Armament	8 13.5-in. 16 4-in.	10 11-in. 12 5.9-in. 12 3.4-in.
Cost	£2,100,000	£2,380,000
Cost per ton	£79.5	£105.1
Coal supply	1000/3500	1000/3100

—*The Marine Engineer and Naval Architect.*

THE GERMAN NAVY.—The German Navy League seems to complain that it has been misunderstood. It has issued a statement in which it defines its policy. Its pronouncement appears to have been issued with the object of correcting some misapprehension or perhaps modifying the policy already declared. The Navy League states that it advocates adherence to the terms of the Navy Law in regard to the complete constitution of the reserve fleet. This provision would not affect the program so far as it relates to the building of battleships, and is probably intended to ensure better training for men. The only change proposed by the League has relation to the construction of the large cruisers or battle-cruisers, of which the legal establishment is 20. Of these 11 are now completed, including two of the *Dreadnought* class, three others are in hand, and a fourth will be provided for in 1912. This would leave five others to be built, which would be laid down under the law at the rate of one each year. The proposal of the Navy League is that they shall be built in half the time, by laying down two each year instead of one. Thus the last pair of the series would be laid down in 1914. The German League adds that a policy of two-keels-to-one, if adopted by this country, would not be alarming, because 20 ships to 40 would be more powerful than four ships to eight. The proportion would be the same, but, according to the German critics, the effect would be greater.

NEW PROGRAM.—The estimates for 1912-13, recently submitted to the Reichstag, amount to $111,254,589. The provisions for new ships are exactly according to the program laid down in the fleet law and provide for the laying down of one battleship to replace the *Brandenburg* and one battle-cruiser to replace the *Kaiserin Augusta*, two scout cruisers, twelve destroyers, one submarine salvage ship, and a sum of $3,570,000 (same as last year) for submarine-boat construction and experiments. There is an

increase in the estimate for maintenance for ships in commission, due partly to the increased size of units and to larger crews and partly to the proposal to establish a third battleship squadron in full commission. This means the keeping in commission of a battleship fleet composed of one fleet flagship and three squadrons of eight ships each, or twenty-five battleships.

A proposal much voiced in the press of late and meeting with popular approval is to accelerate the replacement of the six older large cruisers, laying down their substitutes at the rate of two per year instead of one, as provided in the fleet law.

As usual, there is an increase in personnel to meet the increased needs of the service. Provision is made for 145 additional officers and 3549 enlisted men.—*Army and Navy Register.*

SPEED OF SMALL CRUISERS.—The German cruiser *Stralsund*, which was launched recently, is expected to attain a speed of "nearly 30 knots," and her reported horse-power of 30,000 is 5000 units greater than that for which the *Chatham* has been designed. But then the *Stralsund* is smaller by nearly 1000 tons, and carries a less powerful armament of two 5.9-inch and ten 4.1-inch guns. She is the fourth German protected cruiser to be launched during the present year, the others being the *Magdeburg*, on May 13; the *Breslau*, on May 16; and the *Strassburg*, on August 24. The two first named belong to the 1909 program, and the others to that of 1910, but all four are being built simultaneously and are understood to be of the same type.

FLOATING DOCK.—The German Navy Estimates for 1912 provide, inter alia, for a floating dock for Wilhelmshaven, the dimensions to be similar to those of the dock recently installed at Kiel. This dock is so immense that ample room remains even when one of the *Helgolands* or the *Moltke* is in position. This addition will bring the number of large ship docks at the North Sea yard up to seven, in addition to which the two locks of the new harbor entrance are convertible into dry basins for the very largest vessels. Yet another enormous floating dock is to be built for Brunsbüttel, at the North Sea end of the Kiel Canal, an establishment which is steadily growing in importance. Other floating docks, capable of accommodating *Dreadnoughts*, are to be found at Hamburg, and would be available for war purposes. When the present program has been completed Germany will possess at least twelve so-called *Dreadnought* docks on the North Sea coast.—*Naval and Military Record.*

GREAT BRITAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Monarch	22,500	Armstrong.	Under trial.
Conqueror	22,500	Beardmore.	Launched May 1, 1911.
Thunderer	22,500	London (Thames Iron Works).	" Feb. 1, 1911.
Ajax	23,500	Scotts (Greenock).	Building.
Audacious	23,500	Cammell, Laird & Co.	"
Centurion	23,500	Devonport.	Launched Nov. 18, 1911.
King George V	23,500	Portsmouth.	" Oct. 9, 1911.
Centurion	25,000	"	Building.
Queen Mary	28,850	Devonport.	Ordered.
3		Beardmore.	"
4		Vickers.	"

VESSELS BUILDING.—Continued.

Name.	Displacement.	Where Building.	Remarks.
Armored Cruisers.			
Lion	26,350	Devonport.	Under trial.
Princess Royal	26,350	Vickers.	Launched Apr. 29, 1911.
Australia	18,800	Brown & Co.	" Oct. 25, 1911.
New Zealand	18,800	Fairfield.	" July 1, 1911.
Queen Mary	26,850	Palmer (Jarrow).	Building.
1			Authorized.
Cruisers.			
Amphion	3,400	Pembroke.	Launched Dec. 4, 1911.
7	3,400	"	Building.
Southampton	5,400	Brown & Co.	"
Dublin	5,400	Beardmore.	"
Sydney	5,400	London & Glasgow Co.	"
Chatham	5,400	Chatham.	Launched Nov. 9, 1911.
Melbourne	5,400	Cammell, Laird & Co.	Building.
1	5,700		
2	5,700		
3	5,700		

BUILDING PROGRAM.—Now that orders have been placed for two of the three contract-built ships provided for under the current program there are no fewer than 21 ships of the *Dreadnought* type under construction in this country. Seventeen of these are British, and among them are included three ships which are engaged on or have completed their trials—the *Orion, Lion,* and *Monarch*—and four which have not yet been laid down. A fifth vessel remains to be ordered under the 1911 program. Four foreign ships increase the total considerably, one being under construction for Japan, Brazil, Chili, and Turkey, while each of the two last-named powers has a ship on order. The total number building and ordered, or about to be ordered, is therefore 24, but no fewer than six of these will have been completed by the end of March next, another two (the colonial cruisers) by the summer, and four of the five ships of the 1910 program early in January, 1913, in addition, probably, to the Japanese cruiser *Kongo* and the Brazilian battleship *Rio de Janeiro.* By the spring of 1913, therefore, only nine of these 24 ships will remain in the builders' hands. As opposed to this, however, there are factors on the other side to be taken into consideration. In the first place there is our own program for the coming financial year, which, according to the various "forecasts" that are now the fashion, may include anything from three to six armored units. Further, it has recently been announced that the Spanish Government, not altogether satisfied with the 16,000-ton ships building at Ferrol, intends to order some larger vessels to be built in this country; Portugal is considering a program of three 20,000 or 22,000-ton ships, and in this our own builders should stand more than equal chance with those of foreign countries. China is another nation that may enter the *Dreadnought* lists, with outside assistance, during the year; and, finally, 1912, may see an order placed for a fourth Brazilian ship, the *Riachuelo,* which has been talked of for a long time. Altogether, therefore, the outlook for the British shipbuilding industry for the next two or three years is far from discouraging.—*Naval and Military Record.*

PROGRAM FOR 1912.—The program for 1912 has not yet been published. There is, however, no indication that England's two-to-one policy will not be sustained; this will involve the laying down of at least five large armored ships, several scout cruisers, and a suitable number of destroyers and submarines.

The total naval estimates for 1911-12 amount to $216,036,101, as compared with $197,597,906 for the preceding year; while for 1909-10 the amount was $170,361,950.

The shipbuilding program authorized for 1911-12 provides for the following new construction: Five large armored ships, three protected cruisers, one unarmored cruiser, 20 destroyers, six submarines, two river gunboats, one depot ship for destroyers, and a hospital ship. An increase of 3000 in the personnel for manning the fleet is also provided.

During the year there were completed the battleships *Neptune, Hercules, Colossus, Orion,* and *Monarch,* as well as the armored cruisers *Indefatigable* and *Lion.* Of these the *Orion,* of 22,500 tons displacement, 21 knots speed, and the *Lion,* of about 26,350 tons displacement, 29 knots speed, are the first vessels to be completed by any navy carrying modern 13.5-inch guns and, therefore, mark a new step in the development of the all-big-gun type of ship.

The four battleships which were laid down this year, authorized in 1910, have been given the names of *Ajax, Audacious, Centurion,* and *King George V.* They will have a displacement of about 24,000 tons.

An armored cruiser, to be called *Queen Mary,* authorized at the same time, which was also laid down this year, will have, according to the newspapers, a displacement of 26,850 tons.

The displacement of the 20 destroyers for which contracts have recently been awarded is reported to be of about 920 tons. Press reports state that some of these will use internal combustion engines in connection with turbines.

The E class of submarines at present under construction are reported as having a submerged displacement of about 800 tons, and a new class of still greater displacement is said to be contemplated.—*Army and Navy Register.*

H. M. S. "ORION" COMMISSIONED.—The battleship *Orion,* the first ship completed with 13.5-inch guns, was commissioned recently at Portsmouth. This event had been delayed a few days owing to the accident in the dynamo room, regarding which inquiry will be made when those injured have completely recovered. In view of the fact that the *Orion* is the largest and most powerful ship to be commissioned, remarks the *Times,* and as she has been completed in a remarkably short time without resorting to extraordinary hours of labor, it is interesting to note the chronological course of events. The first keel plate was laid at Portsmouth dockyard on November 29, 1909, and the vessel was launched on August 20, 1910. Part of the armor was then fitted in position on the hull, and the vessel was put in one of the docks at Portsmouth yard and the fitting of the armor completed by June, 1911. The guns and mountings, which were constructed by Messrs. Vickers, Ltd., were fitted on board between April and June of last year. The Wallsend Slipway and Engineering Co., Ltd., received the contract for the propelling machinery, on December 3, 1909, and the whole of the work was completed in their works by November 29, 1910. As the engines were of 29,000 shaft horse-power, this is a highly creditable performance. The machinery was delivered at the dockyard on December 1, 1910, and completed on board and tried alongside the wharf on August 25, 1911.

Details of Steam Trials.—The official steam trials began on September 11 and concluded on September 18. On a 24-hours' trial at cruising speed the power developed was 18,966 shaft horse-power, with a coal consumption of 1.8-pound per shaft horse-power per hour, and the speed of the ship was 19.5 knots, while on the eight-hours' full-power trial the turbines developed 29,108 shaft horse-power, the fuel consumption was equivalent to 1.6-pound of coal per shaft horse-power per hour, and the speed of the ship 21.02 knots. The machinery acceptance trial was run on November 25 last, and the ship was ready for commission on December 29 last. When it is remembered that the ship is 545 feet long between perpendiculars, 88 feet 6-inch beam, and of 22,500 tons displacement at 27 feet 6-inch draft, it will be accepted that the completion in exactly two years from the laying of the keel establishes the efficiency of the dockyard alike

in its equipment and in the organization, for which Sir James Marshall, the Director of Dockyards, is responsible.

H. M. S. "LION."—The *Lion* was built at Devonport, and throughout her history the greatest secrecy has been maintained concerning her. It is understood, however, that her displacement is in the neighborhood of 26,350 tons, her overall length 680 feet, and her beam 88 feet 6 inches. She carries eight 13.5-inch guns and sixteen 4-inch guns. Reports concerning her speed are that it is expected to reach 33½ knots, and her turbines are stated to be of 70,000 horse-power.

In former issues we have given reports of this vessel as they were then current. The greatest divergence in any one case has been in the length. It is not even now known to the outside public what the exact length is, but probably 680 feet is not far from the truth. The beam, we believe to be correctly stated above, and the displacement given is probably not far from the truth.

In the early part of 1910 we endeavored to give in a drawing a forecast of this fine vessel. When this was prepared it was reported that there were only to be two funnels. According to our calculations it would have been impossible satisfactorily to dispose of the products of combustion with only two funnels of such a size that they could be conveniently mounted. We therefore gave the vessel four funnels. It will be observed that actually there are only three funnels, but that that in the center is of very large size, probably as great in area as two ordinary funnels. Moreover, the positions are such that the convenient arrangement of boilers possible with four funnels, to which we drew attention when referring to our picture, has no doubt been taken advantage of.

The substitution of 13.5-inch for 12-inch guns has already been remarked upon.—*Engineering.*

THE "LION."—The British battle-cruiser *Lion* had her eight-hour full-power trial, in the English Channel, on January 8. The contract called for development of the designed horse-power, rather than for a given speed on this trial. The vessel's turbines developed the required horse-power, with coal only, though the weather was so bad that the *Lion* did not return to Devonport till the morning of January 9.

The *Lion* will be the flagship of the first cruiser squadron, commanded by Read-Admiral Lewis Bayly. She was laid down at Devonport, November 29, 1909, launched on August 8, 1910, and completed in November, 1911. She is fitted with Parsons' turbines and forty-two Yarrow water-tube boilers. The length of the vessel is 660 feet; beam, 88.5 feet; displacement, 26,360 tons; designed horse-power, 70,000; designed speed, 28 knots, though it is reported that she made over 29 knots on her trials. Her main armament is eight 13.5-inch guns, mounted on the center-line and so arranged that all can fire on either broadside. She has sixteen 4-inch guns, and three 21-inch submerged torpedo-tubes. The armor extends from the upper deck to about 7 feet below the water-line.

The development of the British armored cruiser has been rapid in recent years. The *Invincible* class (*Invincible, Inflexible,* and *Indomitable*), laid down in 1906, were 560 feet long, 78.5 feet beam with a displacement of 17,250 tons. Then came the *Indefatigable,* laid down in 1909 and completed in 1911, 578 feet in length, 79.5 feet beam, with a displacement of 19,200 tons. This was followed by the *Lion* and the *Princess Royal,* the latter of which was laid down in April, 1910, and is to be completed this year.—*The Navy.*

NEW TYPE OF SUBMERSIBLE BOAT FOR THE BRITISH NAVY.—The Admiralty have placed an order with the Scotts' Shipbuilding and Engineering Co., Limited, Greenock, for the building of a submersible boat of the *Laurenti* type, as constructed by the Fiat San Giorgio Co., of Spezia. The Admiralty in ordering a vessel of the Italian type, the license for constructing which in this country has been acquired by Scotts Company, again prove

their desire to acquire experience of all forms of munitions of war. A feature of the *Laurenti* design is the construction of an outer hull to give the highest propulsive efficiency and reserve buoyancy on the surface, with the minimum of draft, and an inner hull to minimize the internal cubic capacity while ensuring satisfactory conditions when submerged. The double skin, which is braced with stays to ensure the maximum of structural strength, is confined largely to the central part, and the space between the shells up to the water-line on surface displacement is utilized to form water-ballast tanks for submergence. Kingston valves are fitted at the turn of the bilge on each side for the flooding of the compartments, and the structure is made sufficiently strong to enable the water to be pumped out without danger of collapse due to the pressure of the sea water on the outer skin; but compressed air can be, and is normally, used for expelling the water when the boat is to return to the surface. Over the central part of the ship there is a double decking, with lattice bracing, and valves are fitted on each side above the water-line, through which water automatically enters and leaves respectively for the submergence or emergence of the vessel, which is effected on an even keel. This double decking extends practically from bow to stern. Vertical bulkheads divide the interior into several compartments. The new British submersible boat will be of the twin-screw type, with twin six-cylinder Fiat engines in one engine-room, and electric motors, the latter for propelling the boat when submerged. The torpedo-tubes will be forward, under the bow, and the storage-tubes above. Italy, Sweden, Denmark, and the United States have had submersible boats of this design. The Swedish boat is the more notable, as she made a voyage from Spezia to Stockholm without escort. She is 139.4 feet long, 14 feet beam, and 8.2 feet draft, and the voyage was made in stages respectively to Carthagena, Gibraltar, Lisbon, Oporto, Vigo, Ferrol, Brest, Portsmouth, Ymuiden, Kiel, and Stockholm, the longest non-stop run—from Spezia to Carthagena—being 790 sea miles. It is appropriate that the Scotts' Company should be the first of the Clyde firms to build a British Navy submersible boat, since they were the first on the northern river to construct a battleship of the *Dreadnought* type, and have a century-old connection with the Admiralty. They are to be commended for their enterprise in entering upon a new industry.

The "surveying trawler" *Daisy*, which is about to be taken over by the Admiralty from the John Duthie Torry Shipbuilding Co., is the first vessel of the type to be built for the navy. The *Daisy* is in reality a mine-sweeper of some 600 tons displacement.

TOWN CRUISERS.—*Completion of the Group.*—H. M. S. *Yarmouth*, which is on trials on the Clyde, is the last of the four British cruisers of the *Town* class which were ordered under the 1909-10 program. The other three are now in commission. The *Yarmouth* was built by the London and Glasgow Shipbuilding Co., Govan; the *Falmouth*, which is attached to the second battle squadron of the home fleet, by Messrs. Wm. Beardmore & Co., Dalmuir; the *Dartmouth*, now at Devonport with defects, by Messrs. Vickers, Sons & Maxim, Barrow-in-Furness; and the *Weymouth*, which has just relieved the *Doris* in the Atlantic fleet, by Messrs. Armstrong, Whitworth & Co., Elswick. The Dalmuir and Barrow vessels have turbine machinery by their builders, the Elswick ship was engined by the Parsons Co.' and the *Yarmouth* has been supplied by Messrs. John Brown & Co., Clydebank, with Brown-Curtis turbines.

The vessels are "improved *Bristols*," being of greater displacement and having more powerful armament. With a length of 450 feet on the water-line and a beam of 48½ feet, they displace 5250 tons at 15½ feet draft. Compared with the *Bristols*, the freeboard has been increased, especially forward, and the increased stability resulting from the greater width enables them to carry a comparatively heavy armament of eight 6-inch guns and four 3-pounders. The 6-inch guns are mounted on the latest type of

carriage, which enables the centres to be carried out quite close to the ship's side, thus securing almost end-on fire for the broadside guns. Five out of the eight guns can be fired sumultaneously on either broadside, and three ahead and astern. The vessels are fitted with two torpedo-tubes for the latest 21-inch torpedoes.

The *Falmouth* was the first of the three vessels to be completed and to be commissioned. On trial she attained a speed of 27.1 knots. Her machinery is of the Parsons' turbine type, with four ahead and four astern turbines—one ahead and one astern on each of four shafts, and the turbines working in series on two shafts on each side of the center-line of the vessel. Cruising turbines were dispensed with, the high pressure ahead turbine being extended at the high pressure end, so as to increase the range of expansion when running at less than full power, with a by-pass to admit steam at an intermediate stage for the higher speeds.

The *Dartmouth* attained a speed of 25.9 knots while developing 23,500 shaft horse-power. It was anticipated, in consequence of the increased displacement over the *Bristol* class, that the speed would be somewhat less for a given expenditure of power, but a comparison of the trial results of the *Dartmouth* with those of the *Gloucester* of the earlier class show a great similarity of performance. The *Gloucester* obtained a speed of 23.45 knots, with 13,970 shaft horse-power, and the *Dartmouth* 23.49 knots, with 14,290 shaft horse-power. The *Gloucester* at 25.08 knots expended 18,980 shaft horse-power, whilst the *Dartmouth* at 24.97 knots required 18,840 shaft horse-power.

The trials of the *Weymouth* were also most satisfactory. These three vessels have machinery similar in type. In the *Yarmouth*, however, turbines of the Brown-Curtis type are fitted by Messrs. John Brown & Co., Clydebank. They are similar in design to those so successfully adopted in the *Bristol*, which was built at Clydebank. With this type of turbine two shafts only are required, and a lower rate of revolutions is maintained than with the Parsons, thus enabling a higher propeller efficiency to be obtained.—*Naval and Military Record.*

H. M. S. "CHATHAM."—The launch of the new cruiser *Chatham* recently was naturally an event of importance for the eastern yard, at which no large vessel has been built since the *Shannon* was put afloat in 1906. For reasons which are well known the only new vessels whose construction has been allotted to *Chatham* since that year have been submarines, but that the yard is quite able to build larger ships expeditiously is shown by the case of the *Chatham*. From the particulars given of the new cruiser it is evident that her design shows an advance over that of the *Dartmouth*, but not so great as was that of the last-named over the *Bristol*. Whereas the displacement of the *Bristol* was 4800, and of the *Dartmouth* 5250 tons, that of the *Chatham* has gone up to 5400 tons. There will also be no change in the armament from that in the *Dartmouth*—viz., eight guns of 6-inch caliber. On the other hand, there is to be noted a great increase in length and also in horse-power, which rather indicates that the speed of the *Chatham*, which has not been stated officially, will be higher than that of the predecessors, of which the *Bristol* was designed for 25 knots and the *Dartmouth* for 24¾ knots. This would not be surprising, considering that some very fast small cruisers have recently been built abroad.—*Army and Navy Gazette.*

The unarmored cruiser *Amphion*, which was launched at Pembroke dockyard, is a third-class cruiser of the improved *Boadicea* type. Like her sister ship, the *Active*, she belongs to the 1910-11 Navy Estimates; but the two ships are not being built simultaneously. The *Amphion* was laid down on March 15 last, the day following the launch of the *Active*, which has passed through her trials, and is now preparing for commission; the *Amphion* will, it is expected, be ready for the pennant in September, 1912, ships of this class taking rather less than 18 months to build, from laying

down to completion. The *Amphion* is the sixth of the modern third-class unarmored cruisers, and the estimates for the current year provide for the construction of a seventh, which was laid down at Pembroke on November 15. The duty of these ships is to serve, like the older "scouts," as stiffeners and supports to the destroyer flotillas, to which they are attached.

The first keel-plates of a new unarmored cruiser of the *Boadicea* class have been laid down at Pembroke dockyard. She will be the seventh vessel of the type, and will differ from the earlier ships as regards her armament and the type of her turbine machinery.—*Page's Weekly.*

H. M. S. *Archer*, one of the five special destroyers building for the British Admiralty by Messrs. Yarrow, of Glasgow, has had a very successful official full-speed trial on the Skelmorlie deep water measured mile at the mouth of the Clyde. Although the weather was exceptionally bad, a mean speed of 30.3 knots was attained during a continuous run of eight hours, thus exceeding the contract speed of 28 knots by 2.3 knots.

Throughout the trial the whole of the machinery worked perfectly. The special feature of interest was the boiler installation, the boilers being fitted with Yarrow's patent system of superheating; the average superheat during the trial was 94 degrees Fahrenheit, from which a very appreciable gain in economy was obtained.

BATTLESHIPS—ENGLAND AND GERMANY.—The following table shows the number of battleships maintained in full commission by Great Britain and Germany each year from 1904 onwards:

	Great Britain			Germany
	Home.	Foreign.	Total.	Home (total).
1904	16	17	33	8
1905	20	13	33	12
1906	24	8	32	15
1907	26	6	32	16
1908	26	6	32	16
1909	22	6	28	16
1910	22	6	28	16
1911	22	6	28	17

In seven years, therefore, the fully commissioned battle fleets of Great Britain have been reduced by five units, or 15 per cent, while that of Germany has been increased by nine units, or 112.5 per cent.

SPEED OF CONSTRUCTION OF BATTLESHIPS.—The battleship *Centurion*, launched at Devonport on November 18, is the twenty-eighth all-big-gun ship launched this year. The following table of launches shows the rate at which the building of *Dreadnoughts* is spreading.

Power for whom launched.	Year of launch and number					
	1906.	1907.	1908.	1909.	1910.	1911.
Great Britain	1	6	2	3	4	8
Germany	..	..	4	4	2	4
United States	..	..	3	2	1	2
Brazil	..	..	1	1	..	..
Japan	..	..	..	..	1	1
Italy	..	..	..	..	1	3
Russia	..	..	..	..	..	4
France	..	..	..	..	..	2
Argentine	..	..	..	..	..	2
Austria	..	..	..	..	..	1
Spain	..	..	..	..	..	1
Totals	1	6	10	10	9	28

—*Journal of the Royal Artillery.*

BATTLESHIP FLOATING DOCK.—An immense floating dock for the British Admiralty was successfully launched on Thursday, January 4, from the Wallsend shipyard of Messrs. Swan, Hunter & Wigham Richardson, Ltd. Some idea may be gained of its size when it is known that the ground area it covers is no less than two and a quarter acres, while the total height of the side walls is 66 feet. This is one of three docks that Messrs. Swan, Hunter & Wigham Richardson, Ltd., are constructing at present for the British Admiralty, for whom they also built a battleship dock several years ago. This last named was designed for accommodating vessels displacing 17,000 tons, and is stationed at Bermuda. The dock that has just been launched has nearly twice that lifting capacity, namely, 32,000 tons. In addition to the docks built for the British Admiralty, others have been constructed at the Wallsend shipyard for various other governments. The way in which these immense structures can be towed to distant parts is most remarkable. The British Admiralty dock for Bermuda was towed nearly 4000 miles to its destination. The floating dock for the Natal Government was towed over 8000 miles to Durban, and a 7000-ton dock was safely delivered a year or two ago at Calao, the port of Lima, in Peru, the distance from the Wallsend shipyard being about 11,000 miles. Other docks built by the same firm have been towed to various European ports, and also to more distant ones, such as Para in Brazil, Port of Spain in the Island of Trinidad, Egypt, and the west coast of Africa.

The dock that has just been launched is double-sided, and in designing it the builders have been closely associated with Messrs. Clark & Standfield, of Westminster. At the bow end of the dock there is a pair of pivoted flying gangways, to give access from one wall of the dock to the other. In the walls of the dock is living accommodation for a number of officers and men. A complete telephone system is also installed to give communication between engine and boiler rooms and different parts of the dock. There are eight steam boilers, which have been constructed at the Neptune Engine Works of the builders. The pumps have been supplied by Messrs. Gwynnes, Ltd. There is also a very complete outfit of steam and hand capstans placed on the walls of the dock to warp vessels into position. The dock is lit by electricity throughout and on the walls are two electric travelling cranes. In order to facilitate rapid repairs, a commodious workshop is provided in one of the walls with an equipment of machine tools and all necessary plant and appliances. Preservative bituminous enamel and solution by Messrs. W. Briggs & Sons, Ltd., of Dundee, has been applied to the dock externally and internally.

Altogether the dock will represent the most complete and efficient means of overhauling and repairing the largest type of modern battleship yet designed or constructed. It is a worthy product of the famous Wallsend shipyard and a fitting addition to the greatest navy the world has known. —*The Marine Engineer.*

FAST BUILDING.—The trials of H. M. S. *Monarch*, the first of the *Contingent* battleships, have commenced, and the vessel, which has just left Elswick, has proceeded to Devonport to be dry docked prior to the full-power trials. Sir W. G. Armstrong, Whitworth & Co. have created a record in battleship construction in this case, for the vessel was only ordered in April, 1910, and, in spite of the delay occasioned by the shipbuilders' strike last year, was launched in exactly twelve months and completed for trials in the following six. With the Brazilian and Chilian battleships also in hand, Elswick has over 80,000 tons of battleship work under construction at the same time.—*Engineering.*

COALING AT GIBRALTAR.—Another coaling record has just been achieved, and by the same ship—the *Triumph*. She has made a record for the British Navy, and the Mediterranean fleet in particular have good reason to be proud of her. In one morning she took in 640 tons in 1 hour 15 minutes,

the average working out at 512 tons per hour! This is splendid, and too much praise cannot be given for the wonderful organization and the extraordinary energy that must have been forthcoming to produce such a result.—*Naval and Military Record.*

SPEED IN BATTLE-CRUISERS.—It is a matter for extreme gratification that our latest battle-cruisers are likely to obtain a speed of close on 30 knots to the hour; although the contractor speed for the *Lion* group was 28 knots, which in itself was a considerable advance on the *Invincibles* which were designed for 25 knots and only attained 28.6 knots as an "extra." Now the *Lions* are designed for 28, and will probably reach and even exceed 30 knots on trial. The two new battle-cruisers provided by the Colonies and named, respectively, the *Australia* and *New Zealand*, were designed for 26 and will steam over 29 knots. The *Queen Mary* and her sister, although over 1000 tons larger than the *Lion* group, are designed to steam 28 knots only, but will probably exceed 30 at their best. The gratification regarding these speeds comes in when we consider that the ships named will have the heels of nearly every class of destroyer in our own and, what is much more to the point, also in foreign navies. The Germans have 33-knot sea-going destroyers, but this speed could only be attained when the surface of the sea is as smooth as a mirror, and even at such times the necessary current of air in the stokehold to make the boilers do their best, is not forthcoming except such light airs as come from that quarter of the world towards which the vessel is wending her way. The fast battle-cruiser, therefore, will be able to overtake a destroyer or escape from a group of them with comparative ease, in nine cases out of ten. Speed has hitherto been on the side of the destroyers, but this advantage will now be lost unless rapid developments take place in increasing the speed of these torpedo craft.—*United Service Gazette.*

DEFECTIVE "DREADNOUGHTS."—Lord C. Beresford asked the First Lord of the Admiralty, on November 30, whether he was aware that some modification was necessary in the control positions of His Majesty's ships *Orion, Conqueror, Thunderer, Lion, Princess Royal, Colossus,* and *Hercules;* whether he knew that the spotter was stationed abaft the fore funnel and almost over it, and was liable to be suffocated; whether the heat from the funnel often produced a temperature of 220 degrees at the locality where the spotter was stationed; and whether any proposals would be made to remedy this state of affairs.

Mr. Churchill replied: Inconvenience has been experienced in the control positions in the ships named in the question, and modifications are now under consideration.—*United Service Gazette.*

An explosion occurred on the morning of December 12 on board His Majesty's ship *Orion,* at Portsmouth, and the following were injured: Commander Herbert N. Garnett, R. N., Admiralty; Lieutenant (T.) Brian Egerton, R. N., His Majesty's ship *Orion;* Engineer-Lieutenant Henry S. Brockman, R. N., His Majesty's ship *Orion;* Mr. Charles Davidge, gunner (T.), His Majesty's ship *Orion;* Mr. Patrick P. Coleman, boatswain (T.), Admiralty; Albert Hudson, stoker, O. N., D. K. 4817, His Majesty's ship *Orion;* Mr. James Pringle, electrical engineer, Admiralty; Mr. Albert Franklin, assistant electrical engineer; Mr. William Green, inspector of electrical fitters; Thomas Metcalfe, chargeman of electrical fitters, No. 6772; Henry Driver, electrical fitter, No. 8684; William Richards, electrical fitter, No. 8677; John Willis, electrical fitter, No. 6659; William Rycroft, electrical fitter's apprentice, No. 6660; William Ward, electrical fitter's apprentice, No. 8676; Charles Irish, skilled laborer, No. 8695; George Marder, laborer, No. 794; Alfred Goldfinch, laborer, No. 722. All the injured are doing as well as can be expected. Later information added the names of Lieutenants Grant and Parker to the injured. Lieutenant Egerton is a son of Vice-Admiral Sir George Egerton, until recently the Second Sea Lord.

The battleship *Orion*, which is completing for commission at Portsmouth, where she has been built, has already passed her speed, gunnery, and torpedo tests very satisfactorily, and lies in No. 15 dock. A number of experts from London and Portsmouth were assembled on board to see the electrical machinery under full working conditions, and they were accompanied by some of the executive officers attached to the ship. All of them were watching the working of the second dynamo, the first having worked very satisfactorily; the second appeared to be acting very smoothly, with its principal bearings running in an oil-bath, when there was a sudden, sharp explosion, the cover of an oil-tank or bath was blown away, and the compartment was filled with flames.

It is supposed that the dynamo in some way got overheated, while another suggestion is that an electric spark was emitted and ignited inflammable vapor from the oil, but in the absence of any official statement the exact cause is difficult to ascertain. From all parts of the naval establishment medical aid was rendered. Staff Surgeon Nimmo, of the Royal yacht *Alexandra*, was one of the first to arrive, and then came the dockyard surgery doctors and several fleet and staff surgeons. The surgeons, after attending first to the more serious cases, devoted their zeal to those whose injuries were not so severe. After temporary dressing on the ship the men were conveyed to the dockyard surgery. The condition of 14 of the injured necessitated their removal to Haslar Hospital.—*United Service Gazette.*

Orion (battleship, Capt. A. W. Craig), flagship of Rear-Admiral H. G. Hing-Hall, C. V. O., C. B., D. S. O., Second Division, Home Fleet.—The damage sustained by the vessel coming in contact with the battleship *Revenge*, when the latter broke from her moorings in Portsmouth harbor, was not considered sufficiently serious to warrant her detention for docking and repairs. After the present cruise of the division for exercises off the coast of Spain, the vessel, it is understood, will be despatched to Devonport for repairs to be effected.—*Army and Navy Gazette.*

LOSS OF BRITISH "A-3."—The collision of the British submarine *A-3* with the British gunboat *Hazard*, at the entrance to Spithead, on February 2, resulted in the death of four officers and ten men of the *A-3* and the total loss of the vessel. Salvagers have raised what is left of the submarine, in order to recover the bodies and for the purpose of investigation from naval construction points of view.

The collison occurred as the *A-3* was engaged in practice with a flotilla of sister ships. The *Hazard*, passing over the water where the submarine was just coming to the surface, struck her from above and on her side, causing her to sink.

The *A-3* belonged to the earlier type of British submarines, these vessels having been used during the past year for harbor and coast defence maneuvers.

Although no detailed information as to the particular case of the *A-3* has been given out by the British Admiralty, this, like similar accidents to other submarines, in both the British and French Navies, was undoubtedly simply an accident.—*The Navy.*

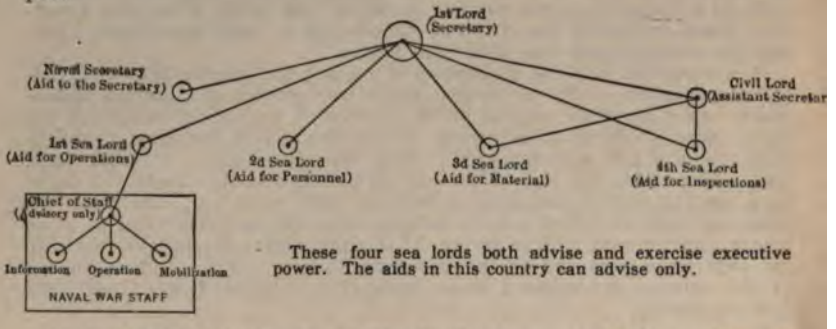
THE ADMIRALTY WAR STAFF.—On January 1, 1912, the First Lord (Winston Churchill) of the British Admiralty created the Naval War Staff, and, in a memorandum, explained its character and duties, the reasons for the same, and that the additional expense involved is to be compensated for by abolition of four of the Admiralty yachts.

The appointments made all date from January 8, and were as follows: Chief of the Naval War Staff, Read-Admiral E. C. T. Troubridge; Director of Operations, Captain G. A. Ballard; Director of Intelligence, Captain Thomas Jackson.

A new office, that of an additional Civil Lord, was also created to look after Admiralty contracts, to be the buyer and business manager of the Admiralty, and to furnish the Third and Fourth Sea Lords with all that they may require in order to build, arm, equip, and supply the fleet.

Additional Civil Lord, Sir Francis Hopwood.

The title of Private Secretary to the First Lord is changed to Naval Secretary, and Rear-Admiral David Beatty had been appointed to this post.



These four sea lords both advise and exercise executive power. The aids in this country can advise only.

In the United States the Naval War Staff is known as the General Board. The latter has more members than the former, but its duties correspond.

The diagram above is to show graphically the similarity of the present organization of the British Admiralty, and our own Navy Department. The words in parentheses indicate the titles of American positions similar to the English positions.

The duties of the members of the Admiralty and Staff are laid down as follows in the memorandum:

Each of the Sea Lords on the Board of Admiralty has a special sphere of superintendence assigned to him by the First Lord in pursuance of the Order in Council. The First Sea Lord is charged with preparations for war and the distribution of the fleet. The Second Sea Lord, who is to be kept in close relation to the First Sea Lord, mans the fleet and trains the men. The Third Sea Lord directs the military construction of the fleet; and the Fourth Sea Lord is responsible for furnishing it with adequate and suitable stores and ammunition. All these heads of large departments will have occasion, in the discharge of their respective duties, to recur to the War Staff or its various branches for general information or for working out special inquiries.

Since, however, under the distribution of Admiralty business on the Board, the First Sea Lord occupies for certain purposes, especially the daily distribution of the fleet, on which the safety of the country depends, the position of a Commander-in-Chief of the Navy, with the First Lord immediately over him as the delegate of the crown in exercising supreme executive power, it follows that the War Staff must work at all times directly under the First Sea Lord. His position is different in important respects from that of the senior member of the Army Council as constituted. The First Sea Lord is an executive officer in active control of daily fleet movements who requires, like a general in the field, to have at his disposal a chief of the staff, but who is not the chief of the staff himself.

A proper staff, whether naval or military, should comprise three main branches—namely, a branch to acquire the information on which action may be taken; a branch to deliberate on the facts so obtained in relation to the policy of the state, and to report thereupon; and thirdly, a branch to enable the final decision of superior authority to be put into actual effect. The War Staff at the Admiralty will, in pursuance of this prin-

ciple, be organized from the existing elements, in three divisions: the intelligence division, the operations division, and the mobilization division. These may be shortly described as dealing with war information, war plans, and war arrangements respectively. The divisions will be equal in status, and each will be under a director who will usually be a captain of standing. The three divisions will be combined together under a chief of the staff.

The chief of the staff will be a flag officer. He will be primarily responsible to the First Sea Lord, and will work under him as his principal assistant and agent. He will not, however, be the sole channel of communication between the First Sea Lord and the staff; and the First Lord and the First Sea Lord will whenever convenient consult the directors of the various divisions or other officers if necessary. This direction is essential to prevent that group of evils which have always arisen from the "narrow neck of the bottle" system. The chief of the War Staff will guide and coordinate the work of the staff in all its branches. He will, when desired, accompany the First Lord and the First Sea Lord to the Committee of Imperial Defence.

Although the methodical treatment of the vast number of subjects to be dealt with by the staff requires that there should be divisions and subdivisions, yet it is imperative that these should never be permitted to develop into "water-tight" compartments. It will be found that there is so much overlapping between divisions, that a constant, free, and informal intercourse between them is indispensable. To promote this, the chief of the staff will be enjoined to hold frequent meetings—to be called "staff meetings"—with the heads of three divisions, and each of the directors will be kept fully acquainted with the work of their two colleagues. Each one of the directors will be ready at any moment to act for the chief of the staff in the latter's absence from whatever cause. In times of profound peace, action has often to be taken immediately on the receipt of some telegraphic report or a request from one of the other departments of state; one of the three directors will therefore always remain within prompt call by messenger, night and day.

The functions of the War Staff will be advisory. The chief of the staff, when decision has been taken upon any proposal, will be jointly responsible with the secretary for the precise form in which the necessary orders to the fleet are issued, but the staff will possess no executive authority. It will discharge no administrative duties. Its responsibilities will end with the tendering of advice and with the accuracy of the facts on which that advice is based.

Decision as to accepting or rejecting the advice of the staff wholly or in part rests with the First Sea Lord, who, in the name of the Board of Admiralty, discharges the duties assigned to him by the Minister. In the absence of the First Sea Lord for any cause the Second Sea Lord would act for him.

The selection of officers to be appointed to this War Staff is to be made in this wise: The president of the college will be entrusted with this important duty, and, in order that it may be carried out to the best effect, he will at all times be in close touch and association with the chief of the staff. In course of time the appointment will be held by a flag officer who has been a staff officer himself. Candidates for the staff will be selected from volunteers among lieutenants of suitable seniority as well as officers of other branches throughout the service, irrespective of their previous qualifications as specialist officers or otherwise, and those who pass the necessary examinations at the end of or during the war college course will be eligible to receive appointments either at the Admiralty or on the staff of flag officers afloat as they fall vacant. In all cases, however, regular periods of sea-going executive duty will alternate with the other duties of staff officers of all ranks, in order that they may be kept up to the necessary standard as practical sea officers. All appointments on sea-going staffs will in the course of time be filled by these officers, and form the proper avenue to eventual employment in the highest staff position at the Admiralty.

THE INITIATION OF A NAVAL WAR STAFF.—Perhaps the first question which the ordinary intelligent man will ask with regard to the Admiralty memorandum on a Naval War Staff is—What is the Naval War Staff to do? What is its precise function. Its function will be to make a special study of the operational side of war in contradistinction from its technical and material side. One of the great defects of the navy at present is the lack of thought and of continuity of thought in tactics, strategy and war operations. An admiral is appointed to the command of the home fleet. During his first year he is absorbed in administrative work, and it is probably not till his second year that he begins to pay attention to tactical and strategical problems. But he has no body of doctrine to assist him; nor has he any assistants specially trained in such work. He probably reflects what his predecessor has already done. Then comes his successor and does it all over again. There is the same lack of continuity with regard to the study of war operations, and there are no systematized methods of war direction. The machinery of a staff organization has been framed in order to supply this deficiency, but it must not be considered as anything more than a framework. The real problem is the collection and training of a body of staff officers. Still the appointment of a chief of staff responsible for the study of war problems and unhampered by administrative work will tend towards a coordination of thought and effort. But the gunnery and torpedo schools were not created in a day, and it will take some years to create a true staff, though its function is clear enough. It is really an expression of the growing complexity of modern warfare and modern industry. In the last forty years, the enormous strides made in things technical and material have absorbed a large part of the mental energy of the service, with the inevitable result that while great attention has been paid to the mechanism and construction of guns and ships, the science of their actual application—for this knowledge is big enough to make an entirely separate science—has been largely neglected. The navy and army differ from every other big business in that they only occasionally perform their business. It is the work of a staff to study just exactly what that business will be, and to ensure its intelligent direction in time of war.

The war college has certainly done something in this direction, and its work must not be depreciated. It is in fact a very essential part of a staff system. But its work is greatly discounted by the shortness of the course (only three months) and the mature age of those who attend it. A number of the officers (most of them post captains) who go there simply look upon it as a full-pay oasis in the arid plain of half pay. This reacts on the spirit of the place, for one dare hardly be intelligent for fear of being called a dreamer by the unintelligent "bloc." It is almost impossible for those outside the service to appreciate how the study of war and of war direction has been neglected in the past. Up to 1900 the word tactics was attached to the performance of certain quadrille movements which had no earthly relationship to the realities of battle. A good deal has been done to improve matters, but the navy lacks original thinkers to sift its work and embody it in clear and simple principles. Or if we have such men, they lack time and leisure. The name and mechanism of a War Staff are only the first step on the journey. We have not yet got a real staff, and the first duty of the staff, when we have it, will be to evolve itself by a process of gradual evolution. We must endeavor to create a certain type of mind—keenly critical and outspoken, but honest and loyal. But the genius of the British officer lies not in criticizing and investigating but in action—in doing things and not in thinking. The naval mind is severely practical, and the practical mind is often an unresilient mind which not only has no desire to investigate things, but is perfectly incompetent to perform such work. Again, much of our best talent has been switched on to technical lines, and, working constantly amongst things material, it seems to find difficulty in moving easily in immaterial spheres of abstract thought and expression. The first

business then of the War Staff will be to switch a certain proportion of the younger talent on to the subjects of war, tactics and strategy.

The first paragraph of the memorandum where a comparison is drawn between war on sea and war on land is weak because it confuses the routine work of a staff with its higher functions. Transport problems are of course radically different on land and sea; but transport problems are largely matters of routine calculation. It is true that these matters do not require so much calculation in the navy, for every ship is self-contained, and transport by water is simpler than transport by land. But so far as higher problems such as commerce-defence and invasion are concerned, the navy has just as much to do as the army. The naval staff officer certainly does not need to worry his head over long march tables, but on the other hand the technical problems he has to solve are more numerous and more varied. Looking at the organization of the staff, the principal relationship to consider is that of the chief of staff to the First Sea Lord. The former is to be directly subordinate to the latter, and his duties will be advisory and not executive. This is as it should be; but it must be clearly understood by the First Sea Lord that the chief of staff is a real and important entity, and not a mere figurehead to supply arguments for proconceived ideas. The relationship of the chief of the staff to the president of the war college is to be one "of close touch and association." This is somewhat nebulous, and is made still more so by the fact that the present holder of the war college appointment is a vice-admiral, while the chief of the staff is a rear-admiral. The memorandum makes it clear that staff officers will be a branch of specialists and will be on the same footing as other specialists. A great number of naval officers look with suspicion on the word "staff," because they imagine it will be used as a kind of "open sesame" to command.

A careful distinction must be made at the very outset between "staff" qualities and "command" qualities. Staff qualities are intellectual, and include a critical scientific mind and a circumferential view of things. Command qualities are largely moral and include decision, common sense, energy and nerve. These latter qualities will just as often be found outside the staff as inside it, and staff officers must understand that their selection and training will give them no more claim to command or to promotion than any other form of specialism. In fact there is no great danger of their thinking it will, for presumably on attaining the rank of captain a staff officer would be merged once more in the line of general work. Again, staff officers must not be divorced from the sea. They must not be left too long ashore—a defect conspicuously evident in the case of many gunnery and torpedo specialists. The fourteenth paragraph of the memorandum discusses the selection and training of staff officers, and this is the crux of the whole question. What is wanted is a critical investigatory type of mind, and in the officers selected to be the first instructors this must be combined with real enthusiasm and interest in instructional work. The memorandum talks of "passing the necessary examinations at the war college," and here there seems a danger of the examination-fetish creeping into the system. An examination is at once the easiest and most fallacious method of testing ability. There should be as few examinations as possible. Problems should be set for investigation, principles explained and criticisms encouraged. Merit should be estimated by an officer's general work and by essay writing, not by examinations which are unsuitable for a staff training whose object is to equip with faculties, not to load with facts.

What is wanted in our staff officers is the critical mind, and the men whom the average captain, hating criticism, would be the last to recommend are possibly the very ones who ought to be selected. Officers who cannot think and write will never be able to initiate a staff. The First Lord has supplied the navy with a good staff house. It is now the business of the navy to fill it with a good staff type.—*Naval and Military Record.*

A CRITICISM.—A week's reflection on the Naval War Staff has shown that it meets with much approval. In summary, all that has been done is to graft on to the existing intelligence and mobilization departments another for working out war plans, and to place all three branches under the orders of a rear-admiral. The sheme leaves the Board of Admiralty supreme, with, however, this important difference—that a well-equipped War Staff will strengthen the hands of a strong Sea Lord and will probably dominate a weak Sea Lord. That the War Staff will compose all differences between naval officers on questions of strategy and tactics is impossible, and it would be bad for progressive naval opinion if it were possible. The scheme has many good points, but it is quite safe to say that at present the majority of naval officers have not come to any definite conclusion upon it. A great deal will depend upon the forthcoming decisions by the First Lord as to the distribution of business, showing exactly to what extent naval administration is likely to be improved by the two new elements at the Admiralty—the War Staff and the new Civil Lord.—*Naval and Military Record.*

A DANGER IN THE NAVAL WAR STAFF SCHEME.—Under the system provided for selection of members of the Naval War Staff, *only* those who have been fortunate enough to have had a special course of training at the War College will know and feel that they can ever receive an appointment at the Admiralty, or on the staff of a commander-in-chief, or to a higher staff position. This follows because, judging by all appointments, service at the Admiralty is always required before such employment afloat.

ITALY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Dante Alighieri	19,000	Gov't Yard, Castellamare.	Launched Aug. 20, 1910.
Cavour.	22,000	" " Spezia.	" Aug. 10, 1911.
Giulio Cesare	22,000	Ansaldo-Armstrong.	" Oct. 15, 1911.
Leonardo da Vinci ...	22,000	Genoa (Odero).	" Oct. 14, 1911.
Scouts.			
Quarto.....	3,400	Venice.	" Aug. 19, 1911.
Marsala	3,400	Castellamare.	Building.
Nino Bixio.....	3,400	"	"

BUILDING PROGRAM.—The naval appropriation for 1911-12 amounts to $37,676,548.

In 1909 the Italian parliament passed a law which established the naval program for each year up to 1916. Recently parliament passed another law extending this program to include the years 1916-17 and 1917-18. A certain sum is allowed each year for new constructions and the maintenance of the fleet. The number and type of ships to be laid down each year is determined by the minister of marine; therefore, it is not possible to know what vessels are to be built until the Navy Department has made its decision after the appropriation is made. According to press reports, three new battleships are to be laid down during the present fiscal year, and plans for new ships are known to be under consideration by the Navy Department, but no official announcement has yet been made.

During 1911 there were under construction the following: Four battleships, three scout cruisers, 10 destroyers, 32 torpedo-boats, and 13 submarines.—*Army and Navy Register.*

PROGRAM FOR NEXT YEAR.—The estimates for 1912-13 amount to $41,859,030. Of this amount $11,580,000 is for the maintenance of existing vessels and for new construction now in hand or to be commenced. Since the naval appropriation law does not specify the number or type of ships

to be laid down—this being left to the discretion of the Navy Department —there is no official information at hand showing the new construction contemplated for the coming year.

In addition, however, to the four large battleships now building it is known that two were recently ordered to be built at government yards, on one of which work was begun in December, 1911, and it is reported that contracts for two more will be let in the near future.—*Army and Navy Register.*

The battleship *Conte di Cavour* has the following characteristics: Displacement, 22,700 tons; length, 551 feet; breadth, 88.5 feet; draft, 27.22 feet. There will be 12 boilers fitted for burning both coal and oil, eight to burn oil only. Four Parsons' turbines. Horse-power, 24,000; speed, 22 knots; maximum coal supply, 2500 tons. Radius of action at highest speed, 1000 miles. Radius of action at economical speed, 3000 miles. Thirteen 12-inch guns in five turrets in same fore and aft line; Nos. 1, 3 and 5 turrets to have three guns each, Nos. 2 and 4 to have two guns each and five over the three gun turrets, giving a broadside of thirteen 12-inch, a bow or stern fire of five 12-inch. Eighteen 4.8-inch 50-caliber guns in armored casemates; fourteen 3-inch; two field pieces; four automatic guns; and three under-water torpedo-tubes.

A battleship of 25,000 tons was put on the ways the last of October at Spezia.

The first of the 12 torpedo-boats ordered from the Odero shipyard of Sestri Ponente was launched October 17. It is named *O. S. 13.*

The submarine *Medusa* in October attained a speed of 14.57 knots, or 2.5 knots over her contract speed.

The captured Turkish ships, *Thetis* and *Derna*, have been placed in the Italian fleet, rechristened the *Capitaine* and the *Benghazi* respectively.

THE ITALIAN FLEET AND TRIPOLI.—The *Popolo Romano* rebukes those excited journals which cry out against the supposed inaction of the Italian fleet, and expect it to bombard Salonica, to penetrate the Dardanelles, and to destroy Constantinople. The *Popolo* says that the fleet has anxious duties, and is ready to act, officers and men being full of patriotic zeal. But this is no reason why the government should be impelled to adopt a course of action based upon perilous delusions which might lead to serious consequences. In short, the Roman journal thinks the game would not be worth the candle. It says that it is folly to believe that active operations of the Italian fleet would induce the Turkish ships to come out from their shelter, and that no glory or credit is to be gained in the open sea. It appears to have been rumored that the fleet had cut the cable between Lemnos and one of the islands, but the *Popolo* says that the question of occupying any of the islands and of blockading the entrance to the Dardanelles or the coast of Syria must be left to the government.—*The United Service Gazette.*

ARMAMENT OF "DANTE ALIGHIERI."—In the *Dante Alighieri*, the first Italian *Dreadnought* now building, there will be four triple turrets, mounted on the center-line, all on the same level, a pair of turrets being placed amidships between the fore and aft superstructures. On a displacement of 19,000 tons, the *Dante Alighieri* will carry, in addition to her turret guns, an armament of twenty 4.7-inch guns, eight of which have been mounted in four small turrets placed well forward and aft on each side, in such position as to interfere as little as possible with the big guns. The placing of these eight guns in this manner is to increase the resistance offered to torpedo attack on the beam or quarter.—*The Navy.*

JAPAN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Aki	19,800	Kure.	Under trial.
Kawachi	20,800	Yokosuka.	Launched Oct. 15, 1910.
Settsu	20,800	Kure.	" March 30, 1911.
Fuso	24,000	"	Laid down December.
Armored Cruisers.			
Kongo	27,000	Vickers.	Building.
Haruna	27,000	Kobe.	"
Kirishima	27,000	Nagasaki.	"
Hiyei	27,000	Yokosuka.	Ordered.
Protected Cruisers.			
Shikuma	5,000	Sasebo.	Launched Apr. 1, 1911.
Yahagi	5,000	Nagasaki.	" Oct. 3, 1911.
Hirado	5,000	Kobe.	" June 29, 1911.

PROGRAM FOR THIS YEAR.—The total naval estimates for the year 1911-12 amount to $42,944,329. This is an increase of $5,234,700 over the estimates for the preceding year.

The Japanese Diet has recently authorized the amalgamation of the existing shipbuilding programs or appropriations into one under the title of "expenses for maintaining naval preparations." The unexpended balance of the existing appropriations amounts to $82,892,305, to which was added a further sum of $40,947,130 for the purpose of enlarging ships already authorized but not yet commenced. The total sum available, therefore, amounts to $123,839,443, which is to be expended in six years—that is, up to and including the fiscal year 1916-17. Out of this there has been set aside for the construction of men-of-war the sum of $78,837,591.

An armored cruiser of about 27,500 tons displacement was laid down January 17, 1911, in England by Messrs. Vickers, Sons & Maxim. Three similar vessels have been ordered to be built in Japan. These vessels are reported as being designed for a speed of 29 knots and will carry either 13.5-inch or 14-inch guns. A battleship which will probably be laid down in 1912 is also included in the present building program.

During 1911 there were completed the battleship *Aki*, of 19,800 tons displacement, and the armored cruiser *Kurama*, of 14,600 tons displacement. —*Army and Navy Register.*

BUILDING PROGRAM.—Two very different reports have been received as to a new naval program which will shortly be placed before the Japanese Chamber. According to one statement a sum of £40,000,000 is to be demanded, to be spread over seven years; while the other states the sum to be £25,000,000 (in addition to £8,200,000 remaining from votes already made), to be spread over either six or ten years. The latter statement adds that the vessels it is proposed to build are three battleships, four battle-cruisers, three third-class cruisers, and a number of river gunboats and mine-layers. —*Journal of the Royal Artillery.*

FLOATING DOCK.—A Reuter's telegram from Tokio says: The new naval drydock recently launched at Nasebo Naval Yard is the largest in Japan. It has taken four years to construct, and will not be quite completed for another four months. It will lift warships up to 30,000 tons. It is 777 feet in length and 111 feet in breadth.

The Japanese Naval Department is arranging to commission shortly a squadron of ocean-going destroyers.—*Naval and Military Record.*

FINANCIAL.—There is nothing very surprising in the announcement which has been made by the Japanese Minister of Finance that owing to

monetary difficulties it is impossible at present to carry out the government's naval expansion projects. Ever since the war with Russia Japan's financial position has been growing more and more unsatisfactory, and large sums have been borrowed. At the end of 1909 the debt stood at £229,718,821, but by the end of last year more than forty-two millions had been added to this. The actual expenditure on the navy does not appear to have increased very much in recent years. In 1901 the estimates were £4,485,892, and although this had been nearly doubled by 1908, they have since shown no decided tendency to increase, as the following figures will show: 1908, £8,094,885; 1909, £7,490,000; 1910, £7,695,647; 1911, £8,803,015. It is not quite clear what is meant by "the government's naval expansion projects." This year, as is well known, no fewer than five armored ships have been laid down or ordered for the Japanese fleet—one in this country and four in Japan—and although no definite news of the progress with the latter group is available, it is certainly more than likely that they have progressed so far that they cannot be retarded for two years (the suggested period of postponement) without necessitating a recasting of the whole design. The present crisis is the issue of a long conflict between the Minister of Marine, Admiral Saito, on the one hand, and M. Yamamoto, Minister of Finance, on the other; and the admiral must certainly have found it difficult to justfy a five-ship program in one year. In all probability this ambitious program was embarked upon as the result of the wide-spread agitation of last year. If so, it is only one more proof of the wisdom of counting the cost before demanding standards or laying keel-plates.—*Naval and Military Record.*

NEXT YEAR'S PROGRAM.—The program for 1912 has not been officially announced. Press reports state that the current six-year program under which four battle-cruisers and one battleship were laid down or ordered in 1911 is to be still further augmented by several battleships during the coming year.

The appropriation for maintenance and construction of ships is a continuing appropriation laid down in the program, the allotment for the year 1912-13 being $24,144,446, as against $21,768,673 for the year 1911-12. This clearly indicates an increase in the amount of construction in hand, aside from any new program that may be introduced.—*Army and Navy Register.*

RUSSIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Sevastopol	23,000	St. Petersburg (Baltic Wks.).	Launched June 29, 1911.
Petropavlovsk	23,000	" "	" Sept. 9, 1911.
Poltava	23,000	" (Admiralty Yd.).	" July 10, 1911.
Gangoot	23,000	" "	" Oct. 7, 1911.
Emperor Alexander III.	22,000	Ivan Bunge Co. (Clydebank).	Building.
Empress Marie	22,000	" "	"
Catherine II	22,000	Nikolaieff (Vickers).	"

THIS YEAR'S PROGRAM.—The naval estimates for 1911, ordinary and extraordinary expenditures, amount to $58,749,655. In addition to these estimates the sum of $15,463,390 was asked for the reequipment of the yards and works under the Ministry of Marine and a further sum of $14,000,000 for new ship constructions, making a total of $88,633,045.

Russia at present has under construction four battleships of 23,000 tons displacement, all of which were launched this year. Contracts were recently awarded for the construction of the following ships, intended for the Black Sea fleet: Three battleships of 22,000 tons displacement, nine destroyers of 1050 tons displacement, and six submarines. The strength of the naval personnel will be increased by 5000 men in 1912.

The Russian Admiralty has proposed a new naval program which provides for three fleets—the Baltic, the Black Sea, and the Pacific; the Baltic to consist of 16 battleships, eight armored cruisers, 16 cruisers, 36 destroyers, and 12 submarines; the Black Sea fleet to consist of a single division, intended to be one and a half times as strong as the naval forces at the disposal of powers in those waters; the Pacific fleet to consist of two cruisers, 18 torpedo vessels, 12 submarines, and three mining vessels. This program has not yet been authorized by the Duma.—*Army and Navy Register.*

NEXT YEAR'S PROGRAM.—The new program of construction for the Baltic soon to be discussed by the council of ministers, covers a period of five years and includes the establishment of new naval bases in the Baltic, besides the refitting of existing bases. Besides the vessels now under construction it is proposed to lay down four battle-cruisers in addition to a considerable number of destroyers and submarines.—*Army and Navy Register.*

THE NEW BATTLESHIPS.—On October 30, 1912, the following battleships were laid down: *Alexander III* and *Empress Marie* at the John Brown works, and the *Catharine II* at Vickers. These ships have the following characteristics: Displacement, 22,500 tons; length, 551 feet; beam, 89.5 feet; draft, 27.5 feet; speed, 21 knots; four turbines; 20 boilers; fuel capacity, 3000 tons. There are four triple turrets for the twelve 12-inch guns, twelve 6-inch guns; two under-water torpedo-tubes. The substitution of 14-inch guns for the 12-inch is under consideration.

The four Russian battleships of the *Gangut* class are now afloat, and it is stated that their places will be taken on the stocks in the Baltic yards by four battle-cruisers of 27,000-28,000 tons and 24 knots, armed with 14-inch guns, probably ten in number. The cost of each vessel is not to exceed £3,000,000. It is also stated that twelve large destroyers and a number of submarines are to be built, the total cost of the whole program being £16,000,000.—*Journal of the Royal Artillery.*

MINE LAYER.—The cruiser *Bogatyr* has been fitted as a mine layer.

TORPEDO VESSELS.—The new North Sea torpedo vessels will displace 1110 tons, and be 316.5 feet long; 30.5 feet beam; drawing 9.1 feet; 22,500 horse-power; three shafts, Parsons' turbines, five boilers; speed of 35 knots; three 4-inch guns; five 18-inch torpedo-tubes; and have a crew of seven officers, six petty officers, and 80 men.

In the Baltic, nine torpedo-boats and four submarines are under construction.

BLACK SEA FLEET.—Vice-Admiral Bostvem, former commander of the Black Sea fleet, has been dismissed from his post, by verdict of the court-martial which has been investigating the circumstances of, and trying him for, the grounding of the battleships *Panteleimon* and *Evstafi*, off Kustenji, in October.

Vice-Admiral Bostvem was found guilty of neglect of duty in not taking proper precaution or issuing proper orders to prevent the grounding of the ships.—*The Navy.*

SPAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
España*.....	15,400	Ferrol	Building.
Alfonzo XIII.....	15,400	"	Launched.
Jaime I.....	15,400	"	Ordered.

* *España:* Displacement, 15,700 tons; horse-power, 15,500 = 19.5 knots; guns, 8 12-inch, 50 cal., 6800; 20 4-inch.

The new Spanish Navy, for which a British syndicate is acting as sponsor, will consist of three battleships of the *Dreadnought* type, three destroyers, 24 torpedo-boats, and three submarines. On the moderate displacement of 15,700 tons an excellent and powerful type of battleship has been evolved. The *Espana* has not yet been launched, but is due for completion towards the close of next year; the *Alphonso XII* is on the stocks, and the *Jaime I*, which will not be completed until 1915, is preparing to build. The main armament of eight 12-inch 50-caliber is mounted as in the *Invincibles*, with the two amidships turrets *en échelon*, so that the broadside is from eight and the axial fire fore and aft from six guns. As in normal British practice the torpedo-repelling guns are 4-inch 31-pounders, but they are arranged, owing to the absence of superstructures, in a main-deck battery consisting of ten guns a-side. Unfortunately, since the average freeboard is only 17-18 feet, these weapons will probably be very difficult to handle in bad weather. The usual Parsons' turbines of 15,500 horse-power will enable these ships to maintain a speed of 19.5 knots or more. Adequate protection, in spite of the slight displacement, is afforded by a complete 8-inch belt, the battle guns being protected by the same thickness, and the secondary battery by 3-inch armor.—*Naval and Military Record.*

SMALLER CRAFT.—Spain has contracted with a British syndicate for three destroyers, 24 torpedo-boats, and three submarines.—*The Navy.*

TURKEY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Rechad V.....	23,000	Elswick.	Laid down in December
Rechadie-Hamess.....	23,000	Vickers.	" " November.

ORDERS FOR BATTLESHIPS.—Official confirmation is given of the order to Messrs. Vickers, of Barrow-in-Furness, for one of two super-*Dreadnoughts*, for the Turkish Navy, the other order going to Messrs. Armstrong, of Newcastle. These vessels will be of about 23,000 tons displacement, and will have a speed of 21 knots. Parsons' turbines are to be used. The guns of each ship will include ten 14-inch weapons, the largest yet placed in any warship, and a secondary armament of sixteen 6-inch guns.—*Naval and Military Record.*

Although her navy has presented a pathetic spectacle during the present disagreement in the Mediterranean, Turkey will one day be able to boast of two magnificent fighting units of the best type. These ships, destined to be known as the *Reshad-i-Hamiss* and *Reshad V*, have been ordered from the firms of Vickers and Armstrong's respectively, and from particulars which have been made known they will be similar in most respects to the British *Orions*, with the exception that the secondary armament is believed to consist of sixteen 6-inch, mounted in a well-protected main-deck battery and reinforced by a large number of machine guns.—*Naval and Military Record.*

UNITED STATES.

VESSELS BUILDING.

No.	Name.	Speed. Knots.	Where Building.	% of Completion Dec. 1.	Jan. 1.	Feb. 1.	Mar. 1.
	Battleships.						
32	Wyoming....	20½	Wm. Cramp & Sons.	84.	88.	90.8	93.5
33	Arkansas....	20½	N. Y. Shipbuilding Co.	81.2	84.5	88.	90.9
34	New York...	21	Navy Yard, New York.	16.6	20.5	23.9	26.8
35	Texas.....	21	N'pt News S. B. Co.	44.4	48.1	51.3	56.1
35	Nevada	20.5	Fore River Co.		Contract awarded.		
37	Oklahoma ...	20.5	N. Y. Shipbuilding Co.		"	"	

BIDS FOR U. S. BATTLESHIPS.—Bids were opened at the Navy Department January 4 for the construction of the battleships *Nevada* and *Oklahoma*, authorized by the last Congress. The vessels are to have a displacement of 27,500 tons, a speed of 20.5 knots, and the cost, exclusive of armament and armor, was fixed by Congress at not more than $6,000,000 each. The bids were as follows:

Fore River Shipbuilding Co., Quincy, Mass., one vessel, with hull and machinery according to plans of the Navy Department, $5,980,000 for one vessel with Curtis turbine engines, $5,935,000; one vessel with reciprocating engines of the bidder's design, $5,955,000.

New York Shipbuilding Co., Camden, N. J., hull, equipment and machinery, according to the Department's designs, but with the substitution of nickel-steel for special treatment steel in portions of the ship, $5,926,000 and $5,965,000.

Newport News Shipbuilding & Drydock Co., Newport News, Va., one ship with hull and machinery according to the Navy Department plans, $6,450,000; two ships at $6,350,000 each.

William Cramp & Sons, Philadelphia, sent a letter announcing that because the eight-hour restriction imposed by Congress would require putting their whole plant on an eight-hour basis they would not make any proposals for either of the two battleships.

The Bethlehem Steel Co., Bethlehem, Pa., proposed to furnish 13,104 tons of Class A armor at $420 a ton and 1674 tons at $480 a ton; Class B armor at $470 per ton for 445 tons, and Class C armor at $508 per ton for 130 tons.

The Carnegie Steel Co., Pittsburgh, Pa., offered to furnish 13,104 tons at $420 per ton; 1674 tons for $480; Class B at $460 for 445 tons, and Class C at $508 per ton for 130 tons.

The Midvale Steel Co., Philadelphia, Pa., offered to furnish 1674 tons at $480 per ton; 13,104 tons at $420 per ton; Class B at $470 per ton for 445 tons, and Class C at $508 per ton for 130 tons.

The *Oklahoma* and *Nevada* will displace 500 tons more than the largest battleships now under construction. The port armor plates of the two three-gun turrets will be 18 inches in thickness, and as far as known the heaviest armor plate of modern construction afloat. The port plates on the two two-gun turrets will be 16 inches in thickness, and thicker than any armor plate on any other vessel under construction by the navy.

By the specifications under which the bids were let the *Nevada* and *Oklahoma* will carry heavier armor throughout than any ship afloat or under construction. The side armor will be 13 inches in thickness, as compared with 11 inches on the *New York* and *Texas*, which are the heaviest armored ships under construction. There will be about a thousand more tons of armor plate on the *Nevada* and *Oklahoma* than on the *New York* and *Texas*.

In a number of other respects the *Nevada* and *Oklahoma* will be a radical departure in naval construction. They will have only one funnel, with three-gun turrets fore and aft and will be oil burners.

BATTLESHIP CONTRACTS AWARDED.—The Navy Department has awarded to the Fore River Shipbuilding Co., at a cost of $5,935,000, a contract for one of the two new battleships authorized at the last session of Congress, and to the New York Shipbuilding Co., at a cost of $5,926,000, the contract for the other. These contracts are for the vessels exclusive of armor and armament.

The *Nevada* (No. 36), the ship to be built by the Fore River Co., will have Curtis turbines, and the *Oklahoma* (No. 37), to be built by the New York Shipbuilding Co., will have reciprocating engines.—*The Navy.*

A 30,000-TON BATTLESHIP.—There are statements in the American press seeming to show that the Navy Department intends to ask Congress for authority to build a battleship of 30,000 tons. It is argued that it will be

well to take a bold step, and to place in a ship of large displacement all the offensive and defensive power, and the best speed attainable. The limiting condition, so far as the United States fleet is concerned, is the depth of the Panama Canal, but 30,000 tons is a possible displacement. American papers say that there is a moral advantage in leading the world. The objectors argue that such a ship as is mentioned would cost too much, but the same reason is advanced against building two battleships instead of one, and, if pushed to a logical extremity, it would lead to provision being made for no battleships at all. The characteristics of heavier armament, better protection, higher speed, longer range of action, and greater endurance are held to increase over the best existing type with every additional ton of displacement.—*Army and Navy Gazette.*

The new torpedo-boat destroyers ordered by the United States Navy Department are distinctly larger than those of last year's program, being 1010 tons total displacement and 300 feet long. The speed is to be 29 knots with 16,000 shaft horse-power, though it is probable that this will be largely exceeded, as was the case with the earlier boats. The time required to build was in all cases 24 months, while the prices quoted for the boats without armament varied from £148,000 to £164,000, several contracts being placed at £152,000. These prices and time to construct are both distinctly greater than obtain in this country. In the boats ordered from Messrs. Cramp, Zoelly turbines will be found.—*The Engineer.*

THE "FANNING."—The torpedo-boat destroyer *Fanning*, authorized by Act of Congress of June 24, 1910, was launched at the yards of the Newport News Shipbuilding & Dry Dock Co., on January 11, 1912.

The destroyer's normal displacement is 742 tons; full load displacement, 883 tons; highest speed on trial (estimated), 29.50 knots; length, over all, 293 feet 10 inches; breadth on load water-line, 26 feet 1½ inches; mean hull draft, 8 feet 4 inches; estimated bunker capacity for fuel oil, 65,974 gallons. She will have three masts and two funnels. The contract price was $630,500.

The *Fanning* has Parsons' turbines, with four Thornycroft boilers. Her generating sets were built by the Terry-Diehl Co., and are 2 kilowatt 5-volt sets. She is armed with five 3-inch 50-caliber rapid-firing guns, and three twin 18-inch torpedo-tubes, carrying six torpedoes; and will have a complement of four officers and 79 men.

The *Fanning* is named for Nathaniel Fanning, of Stonington, Connecticut. He was appointed lieutenant in the United States Navy, December 5, 1804; died October 24, 1805.

Fanning was a midshipman on the *Bonhomme Richard*, and was commended by John Paul Jones for his bravery and prompt obedience to orders; captain of the maintop in the engagement between the *Bonhomme Richard* and the *Serapis*, September 23, 1779. When the most of his men had been killed, he took a fresh gang into the top and succeeded in clearing the tops of the *Serapis* of her men; passed, with his men, when the yards of the ships were locked, from the *Bonhomme Richard* to the *Serapis;* and, directing the fire of his men with hand grenades and other missiles, drove the British seamen from the stations. When recommending Fanning for promotion, Jones said, "He was one cause among the prominent in obtaining the victory."

He accompanied John Paul Jones from the *Bonhomme Richard* to the *Serapis*, and, when Jones was obliged to give up that ship, to the *Alliance*. Jones obtained a position for him on one of the French privateers.—*The Navy.*

SUBMARINES "F-3" AND "F-4."—The submarine torpedo-boats *F-3* and *F-4* (formerly known as Nos. 22 and 23, respectively), were launched by the Seattle Shipbuilding and Dry Dock Co., at Seattle, Wash., on January 6, 1912.

These boats were authorized under the Act of May 13, 1908. The contract price for each is $455,740.—*The Navy.*

NOTES ON SHIPBUILDING PROGRAMS.

The following is the warship tonnage in case vessels now building are considered as completed:

Nations.	Tonnage.
Great Britain	2,324,579
Germany	1,087,399
United States	885,066
France	741,425
Japan	590,119
Russia	473,879
Italy	312,122
Austria	267,442

An examination of the shipbuilding programs of the principal naval powers shows that great activity in warship construction is everywhere manifest at the present time. The manner in which the policy of the all-big-gun battleship now find universal acceptance is particularly illustrated. This is now the only type of battleship constructed, for all of the old-type battleships still under construction at the beginning of this year will have been completed before the end of the year and no more are contemplated.

The year has seen the completion of a new type of *Dreadnought*, namely, the *Orion*, of the British Navy, the first to be armed with 13.5-inch guns and also the first foreign battleship to be completed in which all the turrets are placed in the center line of the ship, the system already in use in the United States Navy.

As noted in the last annual report, a new type of armored cruiser, now called battle-cruiser, is being constructed, but only by Great Britain, Germany, and Japan. Russia is reported as about to do the same. The policies of these countries in this matter, however, are not alike, for, while England is laying down four battleships and one armored cruiser, Germany three battleships and one armored cruiser, Japan reverses the procedure, and her program calls for four armored cruisers and one battleship. The latest of these vessels for England and Japan will displace about 27,000 tons and will carry either 13.5-inch or 14-inch guns.

Not only has there been an increase in the size of capital ships, but also in the displacements of cruisers, destroyers, and submarines. The latest protected cruisers have a displacement of over 5000 tons, destroyers are being designed for 900 to 1000 tons and over, while England and France have ordered submarines which are reported to have over 900 tons submerged displacement and are designed to accompany the battleship fleet in the same manner as destroyers.

Italy and Austria are the only naval powers now building torpedo-boats. —*Army and Navy Register.*

Great Britain, Germany, and Japan have all laid down floating docks able to dock their largest vessels.

The following tables comprise the latest detailed information regarding vessels building, and are of interest. From the *Engineer:*

ARMORED SHIPS LAUNCHED IN 1911

Name	Builders	Launched	Normal displacement	Armament	H. P.	Speed	Machinery	Boilers	Builders of machinery
BRITISH—			*Tons*						
Conqueror	Beardmore	May 1	23,500	10 13.5-in., 20 4-in	27,000	21	Parsons turbine.	Babcock	Beardmore
Monarch	Elswick	March 30	23,500	10 13.5-in., 20 4-in	27,000	21	Parsons turbine.	Babcock	Hawthorn
Thunderer	Thames Ironworks.	Feb. 1	23,500	10 13.5-in., 20 4-in	27,000	21	Parsons turbine.	Babcock	Thames Ir'nw'ks
Centurion	Devonport Yard	Nov. 18	25,000	10 13.5-in., 20 4-in	31,000	21	Parsons turbine.	Yarrow	Hawthorn
King George V	Portsmouth Yard	Oct. 9	25,000	10 13.5-in., 20 4-in	31,000	21	Parsons turbine.	Babcock	Hawthorn
Princess Royal	Vickers	April 29	25,000	8 13.5-in., 20 4 in	70,000	28	Parsons turbine.	Yarrow	Vickers
BRITISH COLONIAL—									
Australia	Clydebank	Oct. 25	19,100	8 12-in., 16 4-in	44,000	25	Parsons turbine.	Babcock	Clydebank
New Zealand	Fairfield	July 1	19,100	8 12-in., 16 4-in	44,000	25	Parsons turbine.	Babcock	Fairfield
ARGENTINE—									
Rivadavia	Fore River Co.	Aug. 26	25,000	12 12-in., 12 6-in., 12 4-in.	39,500	22.5	Curtis turbine	Babcock	Fore River
Moreno	N. Y. Shipbuilding	Sept. 23	25,000	12 12 in., 12 6-in., 12 4-in.	39,500	22.5	Curtis turbine	Babcock	Fore River
AUSTRIAN—									
Viribus Unitis	Stabilimento Tecnico	June	20,000	12 12-in., 12 6-in	26,000	21	Parsons turbine.	Yarrow	Stab. Tecnico
FRENCH—									
Jean Bart	Brest Yard	Sept. 22	23,500	12 12-in., 22 5.5-in.	29 000	20	Parsons turbine.	Niclausse	
Courbet	Lorient Yard	Sept. 23	23,500	12 12-in., 22 5.5 in.	29,000	20	Parsons turbine.	Belleville	
GERMAN—									
Kaiser	Kiel Yard	June 10	23,000	(*a*) 10 14-in., 14 6-in, or	27,000	20.5	Parsons turbine.	Thornycroft.	Kiel
Friedrich der Grosse.	Vulcan, Hamburg	March 23.	23,000	(*b*) 15 12.2-in., or	27,000	20.5	Parsons turbine.	Thornycroft.	Vulcan
Kaiserin	Howalt, Kiel	Nov. 11	23,000	(*c*) 10 12.2-in.	27,000	20.5	Parsons turbine.	Thornycroft.	Howalt
Goeben	Blohm & Voss	March 28.	23,000	(See note) 10 11-in., 12 6-in.	50,000	28	Parsons turbine.	Thornycroft.	Blohm & Voss
ITALIAN—									
C. di Cavour	Spezia Yard	Aug. 10	21,500	13 12-in., 18 4.7-in	24,000	22.5	Parsons turbine.	Blechynden	Orlando
L. da Vinci	Ansaldo, Armstrong	Nov. 14	21,500	13 12-in., 18 4.7-in	24,000	22.5	Parsons turbine.	Blechynden	Ansaldo
G. Cesare	Odero	Oct. 15	21,500	13 12-in., 18 4.7-in	24,000	22.5	Parsons turbine.	Babcock	Odero
JAPANESE—									
Setsu	Yokosuka Yard	April 1	20,750	14 (or 12) 12-in., 10 6-in., 12 4.7-in. (See note)	25,500	20	Parsons turbine.	Miyabara	In England (?)
RUSSIAN—									
Sevastopol	Baltic Works	June 29	23 300	12 12-in., 16 4.7-in.	42,000	23	Parsons turbine.	Yarrow	Baltic Works
Petropavlovsk	Baltic Works	Sept. 9	23,300	12 12-in., 16 4.7-in.	42,000	23	Parsons turbine.	Yarrow	Baltic Works
Poltava	New Admiralty Yd.	July 10	23 300	12 12-in., 16 4.7-in.	42,000	23	Parsons turbine.	Yarrow	Franco-Russian
Gangoot	New Admiralty Yd.	Oct. 7	23,300	12 12-in., 16 4.7-in.	42,000	23	Parsons turbine.	Yarrow	Franco-Russian
SPANISH—									
Alfonso XIII.	Ferrol	(1911)	15,700	8 12-in., 20 4-in	15,500	19.5	Parsons turbine.	Yarrow	Elswick
UNITED STATES—									
Arkansas	N. Y. Shipbuilding	Jan. 14	26,400	12 12 in., 21 5-in	28,000	20.5	Parsons turbine.	Babcock	N. Y. Shipb'ld'g
Wyoming	Cramp	May 25	26,400	12 12-in., 21 5-in	28,000	20.5	Parsons turbine.	Babcock	Cramp

NOTE.—The armaments of the German ships, except Goeben, are doubtful. These ships follow the Neptune design, but it is entirely a matter of speculation whether they will carry (*a*) ten 14-in.; (*b*) fifteen 12.2-in. in triple turrets; (*c*) ten 12.2-in., and have speeds considerably in excess of normal German battleships. Of the three the last is rather the more probable.

It is also uncertain whether the foremost and aftermost turrets of the Japanese Setsu are designed for two guns each or three.

UNARMORED SHIPS LAUNCHED IN 1911

Name	Builders	Launched	Normal displacement	Armament	H. P.	Speed	Machinery	Boilers	Builders of machinery
			Tons						
BRITISH—									
Chatham	Chatham Yard	Nov. 9	5500	8 6-in	25,000	26	Curtis turbine	Yarrow	Thames Ir'n w'ks
Dartmouth	Vickers	Feb. 14	5250	8 6-in	25,000	25	Parsons turbine	Yarrow	Vickers
Yarmouth	London & Glasgow	April 12	5250	8 6-in	25,000	25	Curtis turbine	Yarrow	London & Glas.
Active	Pembroke	March 14	3400	10 4-in	18,000	25	Parsons turbine	Yarrow	Hawthorn
Amphion	Pembroke	Decemb'r	3400	10 4-in	18,000	25	Parsons & Curtis	Yarrow	Hawthorn
Maidstone	Vickers		3000			14	Reciprocating		Vickers
Adamant	Laird		950			14	Reciprocating		Laird
Alecto	Laird		950			14	Reciprocating		Laird
CHINESE—									
Chao-Ho	Elswick	Oct. 23	2750	2 6-in., 4 4-in	8,000	22	Parsons turbine	Yarrow and cylindrical	Hawthorn Vickers
Ying-Swei	Vickers	June 14	2750	2 6-in., 4 4-in	8,000	22	Parsons turbine	Yarrow and cylindrical	Hawthorn Vickers
CUBAN—									
Cuba	Cramp		2055	2 4-in		18	Reciprocating	Babcock	Cramp
Patria	Cramp		1700	1 12-pdr		17	Reciprocating	Babcock	Cramp
DUTCH—									
Hydra	Amsterdam	(1911)	670	3 12-pdr		10	Reciprocating	Yarrow	
Medusa	Amsterdam	(1911)	670	3 12-pdr		10	Reciprocating	Yarrow	
GERMAN—									
Breslau	Vulcan, Stettin	May 16	4750	Probably 2 6-in., 10 4-in. (See note)	30,000	28	A.E.G. (Curtis) t.	Schulz T	Vulcan Co.
Magdeburg	Weser, Bremen	May 13	4750		30,000	28	Bergmann tur.	Schulz T	Weser
Strassburg	Weser, Bremen	Aug. 24	4750		30,000	28	Parsons turbine	Schulz T	Weser
Stralsund	Wilhelmshaven Y	Nov. 4	4750		30,000	28	Bergmann tur.	Schulz T	Wilhelmshaven
ITALIAN—									
Quarto	Venice Yard	Aug. 19	3300	6 4.7-in	22,500	28	Parsons turbine	Blechynden	(?)
JAPANESE—									
Hirado	Kawasaki	June 29	4800	6 6-in	22,500	26	Curtis turbine	Miyabara	Mitsu Bishi
Shikuma	Sassebo Yard	March 30	4800	6 6-in	22,500	26	Parsons turbine	Miyabara	Mitsu Bishi
Yahagi	Mitsu Bishi	Oct. 3	4800	6 6 in	22,500	26	Curtis turbine	Miyabara	Mitsu Bishi
SPANISH—									
Bonifaz	Cadiz	(1911)	813	4 12-pdr	1,100	13	Reciprocating	Yarrow	Cadiz
Lauria	Cadiz	(1911)	813	4 12-pdr	1,100	13	Reciprocating	Yarrow	Cadiz
Laya	Cadiz	(1911)	813	4 12-pdr	1,100	13	Reciprocating	Yarrow	Cadiz
Recalde	Cadiz	(1911)	813	4 12-pdr	1,100	13	Reciprocating	Yarrow	Cadiz
TURKISH—									
Drama	Ansaldo		3800	2 6-in., 8 4.7-in	12,000	22	Reciprocating	Niclausse	Ansaldo

NOTE.—Armament of the German cruisers is uncertain.

ARMORED SHIPS LAID DOWN IN 1911

Name	Builders	Laid down	Normal displacement	Armament	H. P.	Speed	Machinery	Boilers	Builders of machinery
			Tons						
BRITISH—									
Ajax	Scott's Shipbldg. Co.	Feb. 27	25,000	10 13.5-in., 20 4-in	31,000	21	Parsons turbine.	Babcock	Scott's
Audacious	Laird	March 23	25,000	10 13.5-in., 20 4-in	31,000	21	Parsons turbine.	Not settled	Cammell Laird
King George V	Portsmouth Yard	Jan. 16	25,000	10 13.5-in., 20 4-in	31,000	21	Parsons turbine.	Babcock	Hawthorn
Centurion	Devonport Yard	Jan. 16	25,000	10 13.5-in., 20 4-in	31,000	21	Parsons turbine.	Yarrow	Hawthorn
Queen Mary	Palmer	March 6	28,850	8 13.5-in., 16 4-in	80,000	28	Parsons turbine.	Yarrow	Clydebank
AUSTRIAN—									
No. VI	Stablimento Tecnico	August	20,000	12 12-in., 12 6-in	26,000	20.5	Parsons turbine.	Yarrow	Stab. Tecnico
BRAZILIAN—									
Rio de Janeiro	Elswick	Sept. 14	27,500	14 12-in., 20 6-in	(?)	22	Parsons turbine.	Babcock	Hawthorn
CHILIAN—									
Constitucion	Elswick	Nov. 27	27,500	10 13.5-in., 16 6-in	45,000	23	Parsons turbine.		
Libertad	Vickers	Decemb'r	27,500	10 13.5-in., 16 6-in	45,000	23	Parsons turbine.		Vickers
DANISH—									
Unnamed	Copenhagen	(1911)	3,740	2 9.4-in., 4 6-in	5,400	15.9	Reciprocating	Thornycroft.	
FRENCH—									
Paris	La Seyne	Nov'mb'r	23,500	12 12-in., 22 5.5-in	29,000	20	Parsons turbine.	Belleville	La Seyne
France	St. Nazaire	Nov'mb'r	23,500	12 12-in., 22 5.5-in	29,000	20	Parsons turbine.	Niclausse	St. Nazaire
GERMAN—									
"S"	Wilhelmshaven Yd.	May		10 or 12 14-in. (See notes)			Parsons turbine.	Schulz T	Wilhelmshaven
E.—K. F. Wilhelm	Vulcan, Hamburg	July					Parsons turbine.	Schulz T	Vulcan Co.
E.—Weissenburg	Weser, Bremen	July					Parsons turbine.	Schulz T	Wesser
"K"	Blohm & Voss	Sept'mb'r	(?)	10 12.2-in. or else 8 14-in (See notes)		28	Parsons turbine.	Schulz T	Blohm & Voss
ITALIAN—									
"F"	Castellamare	October	26,000	12 13.5-in		22		Yarrow	
"G"	Spezia	Decemb'r	26,000	12 13.5-in		22		Yarrow	
JAPANESE—									
Kongo	Vickers	Jan. 17	27,500	8 13.5-in., 16 6-in	64,000	25	Parsons turbine.	(?)	Vickers
Hi-Yei	Yokosuka Yard	August	27,500	8 13.5-in., 16 6-in	64,000	25	Parsons turbine.	Miyabara	(?)
Fu-So	Kure	Decemb'r	(?)	(?)	(?)	(?)	(?)	(?)	(?)
RUSSIAN—									
Imp. Maria	Ivan Bunge Co. (Clydebank)	Oct. 30	22,500	12 12 in., 20 4.7-in	25,000	21	Turbine	(?)	Clydebank
Imp. Ekaterina II	Nikolaieff (Vickers).	Oct. 30	22,500	12 12-in., 20 4.7-in	25,000	21	Turbine	(?)	Vickers
Imp. Alexander III	Ivan Bunge Co. (Clydebank)	Oct. 30	22,500	12 12-in., 20 4.7-in	25,000	21	Turbine	(?)	Clydebank
SPANISH—									
Don Jamie	Ferrol	(1911)	15,700	8 12-in., 20 4-in	15,500	19.5	Parsons turbine.	Yarrow	Elswick
TURKISH—									
Rechad V	Elswick	Decemb'r	23,000	10 13.5-in., 16 4.7-in	31,000	21	Parsons turbine.		Vickers
Rechadie-Hamiss	Vickers	Nov'mb'r	23,000	10 13.5-in., 16 4.7-in	31,000	21	Parsons turbine.		Vickers
UNITED STATES—									
New York	New York Yard	January	27,000	10 14-in., 21 5-in	32,000	21	Parsons turbine.	Babcock	Cramp
Texas	Newport News	February	27,000	10 14-in., 21 5-in	32,000	21	Reciprocating	Babcock	Newport News

NOTE.—There is some slight doubt as to whether the Rechad V. can be officially considered as laid down in 1911, a remark which also applies to the Libertad.

German armaments doubtful.

UNARMORED SHIPS LAID DOWN IN 1911

Name	Builders	Laid down	Normal displacement	Armament	H. P.	Speed	Machinery	Boilers	Builders of machinery
			Tons						
BRITISH—									
Cruiser A	Elswick	October	5500	8 6-in	25,000	26	Turbine	Yarrow	Hawthorn
Cruiser B	Vickers	October	5500	8 6-in	25,000	26	Turbine	Yarrow	Vickers
Cruiser C	Beardmore	October	5500	8 6-in	25,000	26	Turbine	Yarrow	Beardmore
Scout (unnamed)	Pembroke Yard	Nov. 15	3360	10 4-in	18,000	25	Parsons turbine.	Yarrow	
AUSTRIAN—									
G	Malfoncane	(1911)	3500	7 4-in	25,000	27	Parsons turbine.	Yarrow	Danubius W.
H	Fiume	(1911)	3500	7 4-in	25,000	27	Parsons turbine.	Yarrow	Danubius W.
DUTCH—									
A	Amsterdam	(1911)	540	4 4.1-in	1,200	16	Motor (oil)		Diesel
B	Amsterdam	(1911)	540	4 4.1-in	1,200	16	Motor (oil)		Diesel
C	Amsterdam	(1911)	540	4 4.1-in	1,200	16	Motor (oil)		Diesel
GERMAN—									
E—Seeadler	Krupp	July 11	(?)	(?)	(?)	28			Krupp
E—Geier	Howalt	October	(?)	(?)	(?)	28			Howalt
ITALIAN—									
Nino Bixio	Castellamare	(1911)	3600	6 4.7-in	25,000	28	Parsons turbine.	(?)	
Marsala	Castellamare	(1911)	3600	6 4.7-in	25,000	28	Parsons turbine.	(?)	
Sebastiano Cabot	Palermo	(1911)	(?)	(?)	(?)				
TURKISH—									
1	Schneider Canet	(1911)	510	4 12-pdr	(?)	14	Reciprocating		Schneider
2	Schneider Canet	(1911)	510	4 12-pdr	(?)	14	Reciprocating		Schneider
3	Schneider Canet	(1911)	510	4 12-pdr	(?)	14	Reciprocating		Schneider
4	Schneider Canet	(1911)	510	4 12-pdr	(?)	14	Reciprocating		Schneider
5	Schneider Canet	(1911)	510	4 12-pdr	(?)	14	Reciprocating		Schneider
6	Schneider Canet	(1911)	510	4 12-pdr	(?)	14	Reciprocating		Schneider
UNITED STATES—									
Sacramento	(?)	(1911)	(?)	(?)	(?)	15	(?)	(?)	(?)

NOTE.—One other British scout is on the program, 1911-12, but not yet laid down.

The Austrians are slightly enlarged copies of the Admiral Spaun.

Nothing whatever is known of the German cruisers beyond the meager details given above. It is presumed that they are of about 5000 tons, carrying either twelve 4.1-in., or else some 6-in. guns.

The Italians are slightly enlarged duplicates of the Quarto. The S. Cabot is a gunboat of which no details have been published.

The Turkish vessels are duplicates of the Marmaris, for customs duty, etc.

Nothing is known of the Sacramento except what is here recorded. It is understood, however, that she is merely a gunboat for police duties.

ORDNANCE AND GUNNERY.

SIZE OF GUNS.—The *Asahi* (Tokio) states that the Japanese naval authorities have no intention of mounting a heavier gun than the 12-inch in their new ships. The reasons given are that a greater rate of fire can be maintained with the smaller weapon, and that as the limits of vision make it impossible to fight at a greater range than 10,000 yards, the 12-inch gun, which can penetrate 28 cm. of armor at that range, is quite powerful enough.—*Journal of the Royal Artillery.*

LARGER ANTI-TORPEDO GUNS.—It is not quite likely that we shall soon see a larger gun than the present 4-inch quick-firer used in the capital ships of Great Britain as an anti-torpedo armament, since we are almost alone among first-class naval powers to use a weapon of so small a caliber for this purpose. Guns of 4.7-inch, 5-inch, 5.9-inch, and 6-inch, are the weapons chiefly used by foreign nations for beating off torpedo attack, and considering the excellent 6-inch guns that our manufacturers now turn out, and the amount of ammunition, stores, etc., we have in stock for the latest pattern of this gun, it is highly probable that we shall, if we move at all, step boldly from the 4-inch to the 6-inch gun for anti-torpedo defence. Behind armor, and carried well above the water-line, these weapons would be very effective, although no armor likely to be placed around them will protect them from the destructive fire of the present-day primary guns of battleships and large cruisers. Yet something will have to be done to meet the ever-increasing range of the Whitehead torpedo, of which the 21-inch —excellent weapon and great improvement that it is—is by no means the last word in mobile torpedo production. Already there are rumors of a torpedo of this description which will put the 21-inch very much in the shade, especially in regard to range. To meet such attack the 4-inch gun in British ships will have to give place to guns whose shots travel much further in aimed practice and which can be as easily and rapidly worked.—*United Service Gazette.*

FRENCH GUNNERY PROGRESS.—The interesting gunnery statistics which Deputé Lebail has just applied the Chamber, while testifying to gradual progress, show that the French fleet is not yet quite up to British standards, both for rate of fire and accuracy, mainly owing to the deficiency of the material that was notoriously designed for a slow rate of fire. Thus in 1905 the 12-inch, 7.6-inch and 6.4-inch ordnance (as fitted on board the *Brest* battleships and cruisers) only obtained an abnormally low rate, viz., one round per 2.5 minutes, one round per 1.36 minutes, and hardly two rounds per minute respectively. Today the same weapons (model 1893) fire, on an average, one shot per 1.1 minute, 2.2 shots and 3 shots per minute, which is poor enough, but very commendable when the out-of-date design of the guns is considered. Even the artillery of the *Patries* (1902-5) is not adapted to quick firing, the *Dantons* being the first ships in which this important point has received attention. Six years since battle practice took place at ranges not exceeding 3500 meters, and yet the target was missed 85 times out of every 100 shots. Today the range has been increased to nearly 8000 meters and the percentage of hits exceeds 20—rising exceptionally to over 50.—*Naval and Military Record.*

THE "DANTONS'" RATE OF FIRE.—The 18,000-ton French ships having been designed, like the British *Lord Nelsons*, with a view to combine penetration and volume of fire at moderate battle ranges (from 5000 to 7000 meters), it follows that whatever value is claimed for them will reside primarily in the rate of fire they are capable of attaining. Hence the intense disappointment in naval circles when it was announced recently that the 305 and 240 mm. weapons of the *Condorcet* had failed to come up to the stipulated rate of fire (two and three rounds per minute respectively). Happily these early results—due to the inexperience of guns' crews with

the new material—have been corrected by the splendid performances just accomplished at Toulon and Brest. On board the *Voltaire*, 305-mm. guns were fired every 27 seconds (a rate of 2.2 rounds per minute), whilst a 240-mm. twin-turret obtained 32 shots in five minutes (at rate of 3.1 per gun and per minute). Still better was achieved in the *Diderot*, in which a 240-mm. turret fired 35 rounds in 5 minutes and 20 seconds, which works out at 3.4 per gun and per minute.

Although these performances of picked Frenchmen are not yet quite up to the service standard of the British Navy, which has in this respect an advance of many years, they are nevertheless highly creditable in view of the fact that the new French shells (in contrast with what existed previously) are considerably heavier than British projectiles of similar calibers. This success of the turret design of the *Dantons* (and also of the *Quinets*) has been heartily welcomed among Gallic naval men, who have long deplored that the shortcomings of the artillery material on board the *Patries* and earlier cuirassés should so effectively delay progress in the way of rapid and accurate firing, and consequently minimize the advantage which the naval service might have otherwise derived from the highly efficient gunnery personnel, supplied in adequate numbers by the Toulon "Ecole de Canonnage," as well as from the rational methods of battle practice adopted in the Toulon and Brest "Escadres." In the new 18,000-ton ships, however, up-to-date material will combine with the qualities of the personnel to create battle efficiency.—*Naval and Military Record.*

The Question of the Calibers.—Notwithstanding the decision of the Admiralty to fit 340-mm. weapons in the 1912 ships, and the fact that experimental guns of that caliber are being experimented with at Ruelle, the retention of the 305 mm. continues all the same to be advocated by a minority of naval men, who have just discovered a "fait nouveau" in favor of their contention in the prowess just accomplished at Gâvres by a 12-inch weapon similar to those in the *Dantons*. A Krupp plate 240 mm. (9.4-inch) thick was perforated, at a distance of 5000 meters, and under an angle of 40 degrees, by a 440-kilo "obus alourdi," which is indeed a very hard test, and points to remarkable penetration. It would be folly, they proclaim, to substitute for so perfect a piece of ordnance heavier calibers yet in the experimental stage, and certain, any way, not to combine to so great an extent destructive power with rate of fire. To this plea the Admiralty advisers retort by saying that the first duty of those responsible for naval construction is to look ahead and to provide for the ceaseless advance of maritime science. No more grievous mistake, they hold, could be made than to adhere to a type of weapon which already would prove hardly sufficient at long range, if pitted against the robust belt of a British *Orion*, and which, of course, will have no chance against the very thick armor of the super-*Dreadnoughts* of tomorrow. Only superior "instruments de combat" are truly economical, they add, and obsolete types of vessels can never be cheap. To reproduce next year the *Courbet* design would be a senseless waste of money, the 23,500-ton French ships being certain to be outclassed by the English, German, and American mastodons now building or ordered.—*Naval and Military Record.*

NAVY COMPETITIVE RIFLES.—Following the conference of navy officers last week in the office of the director of target practice and engineering competitions, the rules to govern battle practice in the spring have been completed and are now in the hands of the printer. A number of changes were made. Among them is the requirement that the minimum range of gun-fire shall be 12,000 yards, instead of 9000, as in the last practice. Torpedo practice, by both destroyers and submarines, will be at battleships as targets. The submarines will submerge at a minimum range of 10,000 yards. All the practice of destroyers will be at night, and a submarine night run will also be held. It has been decided to place the reserve fleets

of battleships and torpedo craft on both coasts on a competitive basis as to engineering, it being necessary to keep these vessels ready at all times, as far as the machinery is concerned, to go to sea. Three new competitions as to consumption of coal will be established, namely, for steam launches, evaporators and dynamos.—*Army and Navy Register.*

SHELL FIRE.—Reference was made in a recent letter to German progress in the direction of heavy projectiles. What has actually been done remains a secret, but reports have been heard of an approaching realization of the "six-caliber" shell ideal, free from the defects which militated against the general use of its prototype, the Japanese "portmanteau." Authorities all over the world are agreed that the destructive potentiality of a shell is measured by the size and power of the bursting charge, and not merely by the diameter of the projectile itself. A 6-inch or 8-inch shell penetrating 'twixt wind and water would be almost as damaging as one of 12-inch, in that the first would make an aperture quite large enough to permit the water to enter. On the other hand, the havoc wrought by the explosion of the 12-inch shell after penetration would be incomparably greater than that of a 6-inch or 8-inch. Generally speaking, gunners are confident of their ability to place shells inside the enemy's ship, but they are not yet satisfied with the disruptive effect of the shells, once they have reached that position. It is not impossible that projectile makers, in their anxiety to produce a shell which will perforate intact the hardest armor existing, have given insufficient consideration to the bursting charge. This is, at any rate, the German view. The most formidable 12-inch shell known is the Austrian. It weighs 1010 pounds, but the proportion of this weight contributed by the filling is uncertain. Another powerful projectile of the same diameter is the new French model, whose weight is understood to be 990 pounds. Two types of shell are used with the German 12-inch gun, the respective weights being 980 pounds and 875 pounds. The American shell weighs 870 pounds and the British 850 pounds. The difference in weight between the Austrian and British 12-inch projectiles is therefore no less than 160 pounds.

Bursting Charges.—Unfortunately there is no authoritative table which gives the weight and composition of the bursting charges of the above shells. It is believed, however, that Germany and Austria follow the same procedure in making the walls of the shell abnormally thick and filling with a very high explosive, thus assuring the dispersion of massy fragments at the moment of disruption. In contrast to this, the French, in their earlier mélinite shell at least, combined thin walls with an extremely heavy filling, the consequence being that the exploding projectiles literally pulverized themselves and blasted every light object in the vicinity. An effect not unlike this appears to have accompanied the famous Japanese "portmanteaux." Shells of this description cannot fail to be terribly deadly when directed against warships of the type much in vogue a few years before the coming of the *Dreadnought*, when very little armor was distributed anywhere save on the water-line. But their value has undergone a decline with the introduction of the standard all-big-gun ship, in which the main battle positions are so well protected as to be almost invulnerable to mere explosive assault. A big shell, as the French formerly conceived it, was the vehicle whereby a given quantity of explosive could be planted within an enemy's ship. To attain this object it was necessary that the projectile should be stout enough to withstand the impact at penetration, yet it was desirable not to exceed the minimum thickness required. The same ideal carried to an extreme strove to find expression in the dynamite gun, and it is evidently what the Japanese had in mind when they burst gun after gun in endeavoring to hurl highly sensitive explosives at battle range before the war with Russia.—*Naval and Military Record.*

GUNS FOR GERMAN NAVY.—The announcement is made that Messrs. Krupp have taken up the manufacture of three new types of heavy guns for the German Navy. The new types are stated to be 13.7-inch, 14.1-inch, and 15.1-inch respectively.—*Naval and Military Record.*

"LIFE" OF NAVAL GUNS.—A good deal has been heard about the durability and longevity of Krupp naval guns. It has been frequently stated that the "life" of a Krupp heavy gun is half as long again as that of a wire-wound weapon, and impressive figures have been quoted to support this contention, which it is important to Messrs. Krupp to establish if they are to maintain their present world-wide patronage. As is well known, the "life" of a rifled gun depends upon its caliber, or in other words upon the volume of the powder charge, the gases of which are responsible for the damage done to the rifling and the consequent loss of accuracy. According to well-authenticated German statements, the durability of the 11-inch B. L. (28 cm.) is 30 per cent greater than that of the 12-inch B. L. (30.5 cm.), a fact which may partly explain the original reluctance of the German authorities to abandon the smaller caliber weapon, and the persistent opposition of active naval officers to the proposed adoption of the 14-inch (35.6 cm.) B. L. Although no official data have been given out, the "life" of the Krupp 14-inch model is unofficially estimated at from 80 to 90 rounds. If this estimate is reliable, it would seem that the British 13.5-inch B. L., which in its improved state fires as heavy a shell as the German gun, viz., 1400 pounds, is quite equal in every way to the Essen product, as it is understood to be good for at least 80 or 90 full rounds without deterioration. In the important factor of weight, too, the British gun is said to have the advantage. The ballistics in both cases are a matter of surmise to the uninitiated, but judging from former models the muzzle velocity of the British gun should exceed that of the German.

Altogether it is fairly evident that the latest achievement of British ordnance makers need fear no comparison with the best German guns in regard to power, accuracy, or durability. It is admitted even in Germany that, except perhaps for the practically unknown Krupp 14-inch B. L., the British 50-caliber 12-inch weapon mounted in the later *Dreadnoughts*, is the masterpiece of naval artillery. This appears to be the opinion of all who have had any practical experience of the weapon in question.—*Naval and Military Record.*

IMPROVED LOADING APPARATUS.—If the present inspector of target practice closely follows the example set by his predecessor, we shall shortly be in possession not only of the results of the heavy and light gun-layers' test of last year, but likewise of that still more severe test of real gunnery efficiency, namely, battle practice. One of the most interesting points to attract the attention in this latter competition will be the rapidity of fire from the 12-inch guns. The service of ammunition from the magazines and shell-rooms to the primary guns of our battleships, is admittedly the best in the world. The old well that led from the turret to the shell-room at the bottom of the ship and supplied projectiles and charges by means of cages running the whole distance, has long since been abandoned by British designers, and only the large warships now relegated to the third and fourth divisions of the home fleet are fitted in this manner. In the later ships the service is cut in half, to the great advantage of rapid supply and safety, as an ample series of shot and shell and cordite charges is always on its way from the magazines and shell-rooms to the loading positions in the turrets, without there being any probability of a shell from an enemy's ship finding its way among them. In their later ships the Americans have likewise abandoned the old well system and introduced a service approximating closely to our own. What this service is capable of in expert hands with 12-inch guns, will be gathered from the rapidity of fire attained in last year's gunnery competitions in our own fleet, and a comparison can then be made with the rate of fire obtained on the *Orion's* gun trials with her 13.5-inch weapons. It is believed that there is little or no reduction in rapidity owing to the increased weight of the *Orion's* ammunition, which, it must be admitted, is a very satisfactory state of affairs, creditable alike to the designers and manipulators of the various machines used in loading operations.—*United Service Gazette.*

THE PROGRESS OF WAR MATERIAL IN 1911.—Trouble in Morocco, war in Tripoli, jealousy between Italy and Austria, and unrest in the Balkans, have combined to render the past year a busy one for manufacturers of war material. The greater powers, with the exception of Italy, had already completed their armament of quick-firing field guns, and have of late been turning their attention to field howitzers, mountain guns, and frontier defence guns. All the armies have been increasing their stocks of ammunition.

Field Guns.—No new field gun has appeared. The Deport "scissors trail" gun, already described in these columns, was tried in England in 1911, and did well. The Krupp semi-automatic field gun was described and illustrated in *The Engineer* of June 2, 1911. Italy requires some 600 field guns to replace the old semi-quick-firers, and is now holding competitive trials for their supply. Only two patterns of guns have been selected for trial, namely, the Schneider differential recoil field gun and the Deport gun mentioned above. A sum of two millions sterling has been sanctioned for re-armament. Incidentally it was stated officially that the price paid to Krupp's for a battery of six guns, 18 wagons, one tool wagon, and 7200 rounds was £22,000. Servia has ordered 160 quick-firing guns and 150,000 rounds of ammunition from Schneider's; these are presumably similar to the Schneider guns already supplied. The contract for the conversion of 100 of the old Servian 80-mm. guns was given to Ehrhardt's. Chili has ordered 200 field guns from Krupp's; the gun is a 14.3-pounder of the standard Krupp pattern, similar to the Italian gun. It is to fire both shrapnel and universal shell. Bolivia has purchased three batteries from Schneider's of the same pattern as the Spanish gun. China has ordered 18 field guns and 6000 rounds of ammunition from Skoda, of which 12 were delivered last year. The gun is a 14.3-pounder with Skoda wedge breech; it has the independent line of sight and traverses on the axle-tree. Small side shields are fitted to close the gaps between the main shield and wheels. The buffer has piston valves and no check buffer. On 4 feet 3-inch wheels, with 3-mm. shield, the weight in action is 18.5 cwt., and the weight limbered up with 32 rounds is 30.5 cwt. Spring limber hooks are fitted; there is an automatic fuse setter without differential corrector, and a portable observatory, to be mounted on the wagon, is supplied.

Horse Artillery.—The French are holding trials to select a gun to replace their present H. A. gun, which is too heavy. The ammunition is to be the same as that of the field gun, namely, a 15.85-pound shell with charge giving a velocity of 1730 foot-seconds, and the weight behind the team with 24 rounds is not to exceed 30.5 cwt. These conditions seem difficult to realize except with differential recoil.

Mountain Guns.—Trials are actively proceeding, but no large order has been executed. The type required for central Europe is a 14.3-pounder with M. V. about 1100 foot-seconds, capable of 45 degrees elevation, and fully shielded. This necessitates either the employment of a gun in two parts, artificially weighted as in the Schneider-Danglis pattern adopted by Russia and Greece, or else the differential recoil system. The former system is considered simpler and more practical. Thirty 12-pounder guns of this type were ordered by Turkey from Schneider's as the result of the competition held in 1910, and were delivered in the course of 1911. Bolivia has ordered a lighter pattern of this gun from the same firm, namely, a 12-pounder with M. V. 985 foot-seconds, weighing 10 cwt. in action and forming four loads without shield. Nine batteries are being supplied. Ecuador has purchased two mountain batteries from Ehrhardt's; this gun has controlled recoil, and is a 14.3-pounder, M. V. 900 foot-seconds, firing universal shell.

Howitzers.—The Germans have issued a new 4.2-inch quick-firing field howitzer, firing a 31-pound shell with pointed 4-caliber head, M. V. 985 foot-seconds. The shape of the head is a cubical parabola, which form is now superseding the ogive for field artillery projectiles. Only universal shell

are used. The howitzer is 14 calibers long, and the cradle has rear trunnions, with constant long recoil. It is sighted with the panorama telescope, and is fully shielded. The weight in action with 4-mm. shield is 22.5 cwt. The new Dutch howitzer is a similar weapon, but of only 3.75-inch caliber, firing a 22-pound shell and weighing 20 cwt. in action. The new Austrian howitzer is still in the experimental stage; it is of 4-inch caliber, firing a 32-pound shell with M. V. 985 foot-seconds up to 20 degrees and 1050 foot-seconds above that elevation. It is capable of 70 degrees of elevation. It has the independent line of sight, with range-drum graduated in meters for all six charges; it traverses on the axle-tree. With rear trunnions and constant long recoil, on 4-foot wheels, it weighs 23 cwt., but it is desired to reduce the weight to 20 cwt., and differential recoil is now being tried with this object in view. The Austrians recently mounted a 9.4-inch howitzer and carriage for transportation on three 100 horse-power Daimler motor wagons, so as to render it available with the field army. Servia has ordered 30 batteries of field howitzers from Schneider of Creusot.

Field Artillery Ammunition.—Combined shrapnel and high-explosive shell, now styled "universal shell," are coming into vogue since the introduction of this projectile for the new German howitzer, and all the leading makers have patterns of their own. Krupps use an axial high-explosive burster in the shrapnel, while Ehrhardt and Schneider put the burster in the head. Besides this, the shrapnel bullets are packed in trinitrotoluol, which detonates when the shell is burst with percussion fuse, but burns quietly when it is burst as a shrapnel in air. Modern field shell of this type contain about 45 per cent of bullets, three to four ounces of picric acid in the head or axial burster, and 4 ounces of T. N. T. among the bullets. Macarite, an explosive consisting of 28 parts T. N. T. and 72 parts nitrate of lead, has been introduced in Belgium for filling high-explosive shell.

Balloon Guns.—The Coventry Ordnance Works have produced a new balloon gun, and Krupp, Ehrhardt, Schneider, and Skoda have all supplied a few experimental guns. These are all high-velocity 12-pounders, mounted on motor wagons, and firing smoke-trail shell with sensitive fuses. They are of little use against aeroplanes, and the authorities are waiting to see whether military dirigibles will be introduced on any extensive scale before ordering guns for their destruction.

Small Arms.—The great powers are delaying the issue of automatic rifles, since if any army were to introduce a new rifle its neighbor would immediately produce another and possibly a better one. The only new automatic rifle issued in 1911 was the Genovesi-Revelli, of which 6000 were manufactured at Terni, Italy, for the Bersaglieri cyclists. The Austrians have a new ranging bullet for infantry, which is exploded on impact by a cap. It is stated that the strikes of a half-section volley are visible at 1200 yards. Experiments are being conducted with rifle grenades weighing about 2 pounds, fixed to a rod loaded into the muzzle of the rifle, but these have not at present been adopted as a service projectile. Machine guns are still being manufactured in large numbers to complete the armaments of the principal powers, the favorite patterns being the Maxim, Hotchkiss, and Schwarzlose. Automatic pistols are replacing revolvers in all armies except our own. There is a tendency to evade the difficulty of combining an efficient man-stopping bullet with slight recoil by the use of a large-caliber aluminium bullet; thus the Schonboë pistol is of .450 caliber and fires a 63-grain aluminium bullet with a velocity of 1470 foot-seconds. The high velocity gives great accuracy at short ranges, while the recoil is very slight.

Fortifications.—Italy and Austria are still busy fortifying their coasts and frontiers against each other. The Italians are constructing powerful defences on the Adriatic coast, to be armed with 12-inch guns and 12-inch howitzers. Six 40-caliber 12-inch wire-wound guns have been ordered from Armstrong's at Pozzuoli for the defences of Venice, and the new 15-

inch gun is spoken of for the Brindisi forts. On the land frontier, both sides are mounting 6-inch and smaller guns; Skoda has an order for 50 steel cupolas for machine guns and small quick-firers. These are 8 inches thick, cast in one piece, and weighing 13 to 20 tons. The same firm is turning out revolving turrets for 4-inch howitzers firing up to 70 degrees elevation, and for muzzle-pivoted 6-inch guns. Chili is making Iquique into a first-class fortified harbor armed with Krupp guns, and is building defences at Arica and Tacna. The Turkish Government, in January, 1911, decided to spend a large sum on coast defences, including £75,000 for the armament of Tripoli, but nothing was done till too late.

Air Craft.—The numerous accidents to the great dirigibles have, to some extent, encouraged the construction of miniature dirigibles, which are cheaper and handier than the unwieldly Zeppelins and Parsevals. Thus the Villehad-Forsmann dirigible is of only 800 meters capacity, weighing under 9 cwt. It is non-rigid, with one ballonet, and has a 24 horse-power engine coupled direct to the propeller. It is stated to have attained a speed of 25 miles an hour, but even this would limit its employment to light breezes. On the other hand, the German military dirigible *L. Z. 9*, launched in October, 1911, is a large airship with three motors, capable of 48 miles an hour. Aeroplanes are now being built with more regard for stability and less for speed. Thus the Lohner-Daimler biplane, adopted by the Austrian Army, has the upper plane curved sharply backwards at the ends like the wings of a swallow, while the area of the lower plane is only one-third of that of the upper plane. This construction is said to give great stability in rough weather. With 70 horse-power engine and 9-foot propeller, this plane has a speed of 43 miles an hour. A new projectile for use from aeroplanes and dirigibles is a torpedo-shaped bullet weighing one ounce, intended to be simply dropped on troops below. Owing to its shape this bullet acquires sufficient velocity to kill a man when dropped from a height of 2400 feet. Since a military dirigible of the *L. Z. 9* type can carry some 16,000 of these bullets as ballast, she would be capable of causing considerable annoyance to the enemy's troops.

Searchlights.—The Russian Army has taken the lead in providing means of illumination for troops engaged in night operations. Five hundred motor projectors are being issued to infantry regiments and staffs, and considerably more will be required before the whole army is equipped.

Telegraphy and Telephony.—The Bellini-Tosi system of directive wireless, described in *The Engineer* of January 7, 1911, has been improved by the addition of a second crossed aerial. There are now seven fixed coils and one directive coil, and it is stated that the loss of power which constituted the defect of the original apparatus has been almost entirely overcome. Major Squire, of the U. S. Signal Corps, has invented a multiple field telephone which enables ten stations to use the same cable. Field telephones have been issued on a large scale in the French, German and Italian Armies.

Mechanical Transport.—For ordinary war transport the authorities rely upon the motor vans and lorries in use in the country. But a demand for special fast transport vehicles has recently arisen. The Italians have converted their rifle regiments into cyclists, and are now holding trials to select a pattern of fast 2-ton lorry to form the transport of this corps. The French are organizing mobile frontier forces consisting of large bodies of cavalry and cyclists, and about 400 light motor wagons will be required, since these forces are to keep up their transport complete in peace time.—*The Engineer.*

THE SELF-SCORING RIFLE TARGET.—Invented by Lieut.-Commander M. St. C. Ellis, U. S. N.—The mechanism is exceedingly simple, consisting of a number of designating plates made of special treatment Vanadium steel, cut to the size and shape of the target. These plates are guaranteed to stand the impact of the new Springfield bullet indefinitely. It was found that the unhardened steel plate, one inch thick, would not withstand the

new Springfield bullet; whereas this special plate, of only half that thickness, will endure the impact indefinitely.

These designating plates are suspended from a central holding spindle by steel radial springs. Back of the designating plates and protected thereby is a steel shuttle board which holds the contact-making members. The action of the target when struck by the bullet is as follows: The plate which is hit yields slightly against its springs, thus taking up the powerful blow, while the contact-making shuttle, which normally touches the rear of the plate, flies backward against the tension of a weak spiral spring and completes the electric circuit, making a prolonged contact. The electric circuit thus completed, passes through appropriate cables and actuates an annunciator made up as a replica of the target itself; this annunciator is set in close proximity to the firer. Each designating plate on the target has its corresponding section on the annunciator. When a particular plate is struck a white drop with a black number falls into a hole in the corresponding section at the firing line. The man who is firing can thus tell, even before the report of the impact of his bullet reaches him, where it has struck the target. An electric set-back returns the drop to its original position at the will of the operator and the target is thus ready for the next shot. A battery of 24 volts furnishes the electricity.

The target is portable and does away with pits, tunneling and expensive range construction. Even waste land can be used for range, making it possible for small organizations to own a target and rent the land for stated periods. In fact it can be transported from one town to another, and several companies can thus use the same target, or a man-of-war can carry the targets on board and set them up on shore in a short time for practice, thus obviating the necessity for visiting a regular target range.

As there are no men employed as markers, all danger is eliminated, and persons who like to shoot can go out alone or in small groups outside of working hours and enjoy small-arms practice. One can shoot alone as well as with a squad and all that is necessary to do is to throw in the switch and go ahead. There is nothing about the mechanism that can get out of order. All the working parts are completely incased in a sheet-iron housing making it necessary to have only a covered firing point to use it in all kinds of weather. If desired, a screen may be placed in front of and out of the spatter zone of the target.

During the past nine months a target of this type has been in constant service at the Mare Island Navy Yard, San Francisco, where it has shown such good results that it has been ordered purchased by the Navy Department. A duplicate of the target has been hit over 200,000 times with the new Springfield rifle, the striking energy of whose bullet at 200 yards is 1678 foot-pounds. This is a pretty severe test, and it is interesting to note that the target shows today no signs of deterioration.

As regards the effect of quick reading of results in popularizing rifle practice, we note that a divisional officer from one of the ships on the Pacific coast has stated that the marksmen whom he took to the range for rifle practice were keen to fire at the target, when not otherwise employed, with the result that, during the three days this division was on the range, the target was in constant use.—*Scientific American.*

FRENCH NAVAL AMMUNITION.—M. Painlevé, reporter on the French Estimates for 1912, expresses the view that there is no reason for changing the character of the powder supplied to the navy. He would prefer the now notorious B powder to the powerful progressive explosive of the Germans. He thinks that all that is required is to have the B powder homogeneous and carefully prepared. Foreign critics, he believes, are of this opinion. This powder is at least equal to nitroglycerine powders, but who has sufficient authority to lay down the rules of manufacture or give confidence to seamen? Who is to fix the period of stability for the

powder? He says there must be no mixing of powders whose age differs more than three months. The condition of manufacture must be established, and the services must be secured of eminent chemists, who have been trained in the laboratory of the polytechnic school. M. Painlevé thinks the navy should have a factory for guncotton and two for the existing powders. The history of the powders, not only from Pont-du-Buis, but from other factories, must be carefully scrutinized. The navy must exercise a permanent control over the manufacture, and the new arrangements on this head can only be regarded as a step in the right direction. M. Painlevé also makes some comments on the system of storing ammunition.—*Army and Navy Gazette.*

This corresponds to the general view of American chemists and powder manufacturers. Nothing is wrong with the French powder, it is simply not made properly.

SHIPS' MAGAZINES. *Precautions for their Safety.* (By an expert).—With the disaster to the *Liberté* still fresh in our minds, it may not be amiss to discuss the important question of how magazines should be treated, with the view of eliminating all possibility of any similar occurrence. As the present writer understands the matter, the disaster which occurred on board the *Liberté*, and that which occurred on board the *Jéna* some years ago, where both due to two causes, the nature of the powder which is employed in French men-of-war, and the failure to efficiently arrange the conditions in the magazines in which the powder was stored to provide against the peculiar action to which such powder is subject. The occurrence of the explosion on board the *Liberté*, following that of the *Jéna*, naturally led many of those who have studied the subject, to think that the explosion on board the United States ship *Maine*, which it will be remembered led almost directly to the Spanish-American War, might also have been caused in the same way. The report of the experts who investigated the question nullifies this supposition. According to the report, although the principal damage which was done to the *Maine* was due to the explosion of her own magazines, the primary cause was the explosion of a bomb or a charge of some kind under her bottom. The heat caused by this explosion led to the later explosion of the own magazines, and the question may therefore arise whether the use of similar powder in the American Navy as in the French Navy did not amount to what lawyers call a contributory cause. At the present time, as the writer understands, only France, Russia, and the United States use the particular powder which is believed to have caused the disaster on board the *Liberté*, in their navies. As he understands the matter, the powders used in the French and other navies mentioned differ in their properties from that used in the navies of the United Kingdom, Germany, Japan, and Italy to a very important extent. The powder used in the French and American Navies has the great advantage that it has not such a great erosive effect upon the gun barrels as the powder used by Great Britain and the other powers named. This is undoubtedly an important advantage, in view of the increasing size of the guns mounted by the modern battleship and of their increasing cost. It is not only that the life of the gun is shorter with the powder used in the British Navy, and therefore the gun must either be relined or replaced after a certain limited period, but in case of war the limit of its useful life might have an important bearing upon the fate of a war, and even upon the fate of a particular action. Hence the use of the less erosive powder by the United States Navy. In both powders an attempt has been made to place as high an explosive power as possible within as small a compass as possible, consistent with the whole of the explosive power being brought into operation within the time that is available for the burning of the charge.

Complete Combustion.—One of the problems with which artillerists have been faced since the advent of rifled guns, with their greater accuracy, higher muzzle energy, and the increased energy required to be expended

upon the shot or shell before it leaves the mouth of the gun, has been the complete combustion of the charge. In the old smooth-bore gun, as in so many other machines of the old days, no effort at accuracy or economy of powder was made. The one thing aimed at was to force the spherical mass out through the gun at as high a speed as could be managed under all the conditions. With the modern gun all that has been altered. The space that can be allotted to the powder charge is strictly limited, the time during which the charge is exerting its power is also strictly limited, and the problem involved in utilizing the power to the fullest extent is by no means an easy one. The powder charge in a gun and the charge of gas and air in a gas engine are very much alike. The action is almost the same in the two cases. The piston of the gas engine corresponds to the shot or shell in the case of the gun. In both cases the force exerted upon the piston or upon the shot or shell is due to the heat liberated by the burning of the charge, and the consequent instantaneous expansion of the products of combustion. The more quickly the charge can be burnt, the more rapid is the development of heat, and the greater and more rapid is the expansion of the gaseous products formed by the combustion of the charge. But in both cases, if the combustion goes on at more than a certain speed, the whole of the charge cannot be burnt. In the gas engine and in the gun the object to be moved, the piston and the shot or shell, commences its motion almost immediately the charge is fired; and, therefore, unless the ignition can penetrate to every part of the charge before the shot or shell has moved a certain distance in the case of the gun, and before the exhaust valve opens in the case of the gas engine, a portion of the charge may be blown out unburnt.

Modern Powders.—On the other hand, it is of great importance that the pressure behind the shot or shell in each particular case shall be as uniform as possible. That is to say, good shooting, accurate shooting, and large percentages of hits require that the force with which the projectile is ejected from the gun, and the manner in which the force is applied to the projectile, shall be as uniform as possible under any given conditions. It has been proved that all smokeless powders, which include practically all powders now used in the navies of the world, increase the pressure which they developed when fired in the gun if they have been exposed to a temperature above a certain figure. For the powders used in the British Navy a temperature of 20 degrees Centigrade, corresponding to 68 degrees Fahrenheit, is the limit. All powders of the modern kind, into which nitroglycerine enters, have the property that is common to a great many chemical compounds and chemical mixtures—that almost from the moment of their being made up decomposition commences, with a certain generation of gas. It is a peculiarity of nearly all chemical compounds which behave in this way that the decomposition and the delivery of gas increase very rapidly with increase of temperature. The powders used in the British Navy have the great advantage that they do not require to be hermetically sealed, while the powders used in the French and American and Russian Navies do. Hence it follows that with powders in which nitro-cellulose is the principal ingredient, if they are exposed to temperatures above those mentioned, gas is liberated freely within the sealed packages containing the powder. The continued liberation of gas is very much like the continued generation of steam in a steam boiler. If it continues, and there is no safety valve, a time arrives when the pressure set up by the gas bursts the case in which the powder is enclosed. In addition to this, the compression of any gas, however produced, raises its temperature, and in the case of the gases liberated by the decomposition of the powder, the time at which the case is burst may coincide with the time at which the heat present is sufficient to ignite the gases themselves. In any case, if ignition takes place before the case is burst, a greatly increased generation of gas results, followed immediately by the bursting of the case and the liberation within the magazine of a considerable quantity of heated gases. Bearing in mind that there will usually be a

quantity of other explosive in a state of strain, at least in the magazine, the result which followed in the case of the *Liberté*, the *Jéna*, and in the *Maine* is practically a natural sequence.

Influences on Temperature.—Now, as to the conditions under which magazines have to do their work, to hold their charges of explosives harmless. Magazines are necessarily placed low down in the ship to be out of the way of shell. Necessarily also they are connected with the turrets or barbettes they are supplying by masses of iron. They are also enclosed by masses of iron. The whole ship is a mass of iron. The ship, when under way, is propelled by steam generated in boilers, and consequently a considerable amount of heat is liberated there, apart from that employed in raising steam, and the conducting mass of metal of which the ship is composed carries the heat in all directions, and amongst others to the wall of the magazine. Further, when firing takes place, a considerable quantity of heat is liberated within the turrets and barbettes, and this is conducted directly to the magazines below. The result is, naturally, that the temperature rises within the magazines, and if powder is carried which is obliged to be hermetically sealed, and no means are taken to neutralize the rise of temperature, the decomposition and generation of gas described above goes on continuously, and the disastrous results that have become only too familiar follow.

How Magazines should be Treated.—The magazines of most navies, the writer believes, are already treated by the circulation of air that has been cooled continuously passing through them. He would suggest that it would be possible to lessen the work which the air has to do, and to increase the safety of the magazine by insulating it thermally wherever it is possible. There are a number of thermal insulators employed by refrigeration engineers to line cold chambers on the inside. The problem involved in keeping a cold chamber cool is exactly the same as that involved in keeping a magazine cool. Heat may be prevented from entering the magazine, and any heat which does enter may be carried away. There will be difficulties in the way of thermally insulating a magazine in the same manner as a cold chamber designed to preserve produce is insulated, but a good deal may be done. As with electricity, there is always the difficulty of providing efficient insulation, because the thermal insulators are mechanically weak. Some of those that have recently been put upon the market, compressed cork for instance, are very much stronger and more easily applied than the earlier forms, with which wood casings had to be built and the insulators filled in loosely and rammed down. Compressed cork, the writer believes, could be applied to line the walls of magazines, so that there would be no direct transference of heat in that direction; the roof and floor could also be lined, and it would be possible, he believes, by careful design, to work in insulators, so as to reduce the amount of heat transmitted even from the turrets.

For cooling the magazines, after all that is possible has been done in the way of insulating them, the cold air system already in use could hardly be improved upon. The use of cold dry air is the latest development employed by refrigeration engineers. It has the important advantage that it clears all moisture out of the room it is employed to cool, and this will be of great value in the case of magazines, and particularly with the powder used in the British, German, and other navies. Moisture plays an important part in the decomposition of the powders referred to above. With the powder used in the British Navy, hermetically sealing is not necessary, and therefore the passage of a current of cold dry air over the surfaces of the packages containing the powder will carry off any moisture that is liberated and keep the powder dry. The old saying, "keep your powder dry," is as important today as it was in the Napoleonic wars.

Cooling air by passing it over a grid of pipes in which either cold brine or carbonic acid gas is present also dries it. The capacity of air for holding moisture increases with its temperature, and consequently if the temperature is lowered the ability to hold moisture is also lowered, and the

moisture is deposited upon any cold surface that is present, and the air passes on dry. It appears to the writer that the cooling air might be carried with advantage below the figure that rules in the British Navy.—*Naval and Military Record.*

THE INFLAMMABILITY OF CELLULOID.—It is well known that celluloid is highly inflammable and on various occasions has caused loss of life and property. The chemical process of its combustion has recently been studied by Dr. Panzer, of Vienna, and the results of his experiments are of great value to science and industry; as they show a way of dealing with a celluloid blaze. This substance does not ignite spontaneously; but it was found that after extinguishing the flames of a piece of burning celluloid, decomposition would still go on, and would continue even in a vessel filled with carbonic acid or steam. This shows that atmospheric oxygen is not necessary for decomposition; that a fire caused by celluloid can only with difficulty be put out with water, and that ordinary chemical fire extinguishers are useless. The flameless combustion starts at a temperature of but little over 100 degrees Cent. (212 degrees Fahr.) so that the decomposition may be started by a flame situated quite some distance away. The white vapors resulting from the combustion form an explosive mixture with air. To extinguish a celluloid blaze in a building is a most difficult task, if not impossible. On account of the rapidly spreading flames and the excessive heat of the fumes (nearly 750 degrees Fahr.) the seat of the blaze is almost inaccessible to the fire fighters. Ignition and gasification of celluloid may be caused by an open flame or simply by heat. The temperature required for decomposition lies between 105 to 185 degrees Cent. (221 to 365 degrees Fahr.), therefore a hot stove can cause the decomposition. If a piece of celluloid is slowly heated, it may be observed that it softens at first, then blisters begin to appear all over and suddenly decomposition sets in, sometimes accompanied by flames. The products of dissociation consist of gases, liquids and carbonaceous matter. The colorless gases contain carbon monoxide and nitrogen oxides and are therefore extremely poisonous.—*Chemiker Zeitung.*

DISCUSSION OF THE "LIBERTÉ" IN THE FRENCH CHAMBER.—The official *Liberté* inquiry was conducted by a board of line and staff officers headed by Rear-Admiral Gaschard, a highly thought-of officer, whose name alone was a guarantee of wisdom and impartiality.

This board's report was awaited with great anxiety. It was remarkable for its moderate tone and clearness, showed the efforts made in search of the truth, and concluded that the cause was the spontaneous burning of a cartridge of B powder in one of the forward two starboard 19 cm. magazines.

In the Chamber, all the speakers, with the exception of M. Painlevé, have accepted this. Although he considers this cause quite probable, yet he still is in doubt, and refuses to attribute only to the powders alone the responsibility of the disaster. "You know," he states, "that this is the conclusion of the board of inquiry, and I must say that, without feeling certain, I consider this explanation as the most reasonable." M. Painlevé is by no means certain that a fire had not started from some other cause in the 19 cm. magazines. "Everyone recalls," he states, "the value of the witnesses at the inquiry, I am not very sure that it is necessary to deviate from the unlikely theory according to which the beginning of the fire started in magazine of 47 mm. and 65 mm. which contained the oldest ammunition, put up in 1898."

We will consider, as well grounded, the doubt expressed by M. Painlevé on the particular magazine which might have been the starting point of the accident.

The verdict of the board rests on a lone witness, that of a sailor who was on the upper deck, and who heard three successive explosions, separated by an appreciable interval: "There are three cartridges of the

same pile which have successively exploded," concludes the board, but this finding is not certain.

But the question of knowing in what condition the decomposing powder grains would have to be to ignite was made the object, in 1907, at the laboratory central of Poudres et Salpêtres, of experiments which led to conclusion that a proportion of decomposing grains in the charge would not imply the danger of ignition, and that it would be necessary to have decomposition in bulk, as in the experiments at Versailles, to place the powder in the condition for spontaneous ignition.

These experiments tended to prove that the presence of some decomposing grains in the magazines which burned the *Liberté* would not be a serious presumption in favor of the hypothesis of a spontaneous ignition.

M. Chautemps knows well that the powders have been made without any care; but he believes in other causes of the disaster.

We would not have had the disaster of the *Liberté* if the suspected magazines had not contained all the right elements for making a huge fire follow an explosion of 50 seconds of the powder B; it is a big fire, a fire of wood, and of paints, which in 19 minutes caused the explosion of the shells.

In the Chamber, M. André Lefèvre, whose remarks are always well considered and in perfect good reason, has held the theory that our war powder well made is good, but that, like all powders in the world, it demands careful watching; the *powder B*, of which he accepts the spontaneous ignition, *has been*, in the explosion of *Liberté; only the match setting the fire to the woodwork and the paints;* the flames of the powder would have been powerless, because of their short duration and of the mass of shells, to bring them to the temperature of the explosion of mélinite, but they lighted a big fire, a fire of wood and of paint, in which the shells have grown hot, following the words of M. Lefèvre, during 20 minutes, and thus the shells exploded.

The shells are the only real dangerous element to the safety of the vessel. *A magazine ought not to contain wood, paint or shells.*

. . . The experiments at Gavres showed the need for the separation of the shells, of the exclusion of all combustible matter, of the installation of instantaneous flooding apparatus, maintained constantly under pressure, and an automatic starting device! We know that the disposal of the primers or of ignition charges installed in the cartridges and the tanks render more and more probable the extending of the fire from one cartridge to the next! And we keep, nevertheless, in the powder magazines, wood, paint and shells! The flooding under pressure, the flooding automatic were not even studied! We are *now* studying them!

The true responsibility lies in the conditions, and it is not only against the spontaneous combustion that precautions ought to be taken; the most stable powder would be exploded by awkward handling of the cases, fall, or friction, or by secondary causes of which we have seen so many examples, as the neighborhood of a warm bunker. It is unfortunately not illogical to think longer of malevolence.

When the necessary precautions have been taken against the consequences of a sudden ignition and against the existence of faulty ammunition, our sailors will be able to have an absolute trust in the worth and the security of the fighting implements placed at their disposal.—Translated and abbreviated by the Editor from *Le Moniteur de la Flotte.*

The necessity for removal of wood and paint from our magazines is here again emphasized.

RESULT OF "LIBERTÉ" COURT-MARTIAL.—The court-martial, presided over by Admiral Jauréguiberry, has exonerated from all blame the officers of the battleship *Liberté,* in connection with the recent disaster.

Captain Jaures was relieved of responsibility because of his absence from the ship on leave at the time, and the court-martial not only acquitted Lieutenants Garnier and Bignon, but warmly congratulated them on their behavior at the time of the accident.

Lieutenant Garnier was temporarily in command of the *Liberté* at the time of the explosion, which resulted in the death of 235 men and serious injury to nearly 100.—*The Navy.*

ARMORED SHIPS OF NOT?—A correspondent suggests that even as the use of gunpowder in warfare led to the abandonment of suits of armor as a protection to the caparisoned warriors of old, the all-big-gun idea in battleships may soon lead to the abandonment of the custom to protect the vital parts of ships of the line with armor plating. The analogy is by no means as irrelevant as it may appear at first glance and deserves more than passing notice, being based upon the superiority of the gun over the armor plate. From the time of the epoch-making armored French batteries engaged at Kinburn down to the present day a bitter duel has been fought between the gun and the armor plate. Sometimes the armor plate has won, but always the gun has regained the mastery; and this mastery over the armor plate obtains today, with the additional factor that for its given weight something like finality has been reached in armor plate resistance and the big guns of today shoot through this finality with ease. The 13.5-inch gun mounted on the *King George V* class of British battleships throws a projectile of 1250 pounds in weight which will pierce 14.4-inch of Krupp cemented armor plate at 7700 yards. At 5400 yards, the same shell will pierce 16.3-inch of Krupp plate. The 1582-pound missile of a 14-inch gun will pierce 15.6-inch of Krupp plate at 7700 yards and 17.3-inch at 5400 yards. The 1950-pound shell of a 15-inch gun would go through 17.2-inch of plate at 7700 yards and through 18.9-inch at 5400 yards, while a 16-inch weapon firing a 2367-pound shell would penetrate 20.5-inch of armor plate at 5400 yards and 18.8-inch at 7700 yards. Of course, armor will keep out the shells of the secondary battery, but at the ranges contemplated for future warfare, outside of anti-torpedo protection the secondary armament need not be taken into consideration. At the rate of one hit per minute, which may be confidently expected of well-trained gunners, it is inconceivable that any amount of armor on a battleship could resist the terrific impact of a succession of shells fired by a ship mounting, say, ten 14-inch guns. Outside of the economical advantage in discarding the costly armor protection, how could an unarmored ship of the line be built with offensive power superior to that of the armor-plated ships? Simply by utilizing the 5000 tons of weight and the two and a half million dollars thus saved to increase the speed and double the number of the guns. Imagine a battleship with a speed of 40 knots and armed with twenty 16-inch guns firing projectiles weighing about a ton apiece. Such a ship could destroy a squadron of present-day battleships by reason of the terrible smashing power of its guns and its ability to choose its own range and outsteam and outmaneuver its opponents.—*Shipping,* Illustrated.

MARINE ENGINEERING.

MARINE INTERNAL COMBUSTION ENGINES.—The events of the past year all go to show what a keen interest has now been aroused, among technical men at all events, in the question of the application of the internal combustion engine to ship propulsion. Nearly every scientific institution which could by any means consider the subject as within the scope of its proceedings has had a paper dealing with some phase of the question. This may be taken as only a straw which shows the way the wind is blowing but another quite unmistakable indication lies in the great number of important marine engine building firms which it now appears have taken, or are contemplating taking out licenses to build marine engines of the Diesel type. There is, on the other hand, very little in volume—though much in interest—that can be said as to what has actually been accomplished in this direction in this country at all events; though, as we suggest, there is plenty upon which we can build hopes for the future, and

many of these proposals should come to fruition in the early part of this year, when we shall deal with them as they deserve.

Long Voyages.—The most practical event of the year in this connection was, to our mind, the putting into service of Diesel-engined tank ship *Vulcanus*, built by the Nederlandsche Fabriek of Amsterdam for the Nederlandsche Indische Tankstoomboot Maatschaapij. This boat, which we described fully in January, is, it will be remembered, of 1900 tons displacement, with a carrying capacity of 1000 tons, and is fitted with a 500 horse-power six-cylinder four-cycle Diesel engine, built by the Nederlandsche Fabriek. After some six months' work in short coasting trips to gain experience and confidence, she made a 19-day run to Constanza, a distance of just over 3300 miles, on a consumption of 2.15 tons of oil per 24 hours at a speed of about 7¼ knots. So successful has she proved that a pair of ships of double the horse-power are now under construction for the same owners by the same builders. A bigger but less powerfully engined boat is the *Toiler*, built by Swan, Hunter and Wigham Richardson, Limited, with a carrying capacity of 2500 tons, and fitted with twin-screw engines of 350 combined horse-power of the two-cycle type, built by the Swedish Diesel Motor Company, of Stockholm. This boat again was kept to short trips for some months, but in the autumn took to herself an historic interest by crossing the Atlantic, and is, we understand, now giving satisfaction in regular service on inland waterways. A third full-powered Diesel-engined ship is the Italian *Romagna*, which was put on to the *Trieste, Ravenna* and *Fiume* service late in the summer, but was unfortunately lost in one of the November gales. This combined passenger and cargo ship was fitted with two sets of 400 horse-power Sulzer-Diesel engines, which gave her a speed of 12¼ knots, and she was described in our issue of December 22. The result of the inquiry which is now being held as to the cause of her loss will be awaited with much interest, though from what we hear we do not gather that it was in any way due to failure in the engine-room department, and we should not be surprised to hear that it was entirely a question of ship and cargo. Whatever the cause, her loss is greatly to be regretted, as it is sure to give occasion for the opponents of the internal combustion engine to decry this form of motive power; but what is of infinitely more importance, the opportunity of gaining valuable experience, which is so particularly necessary just now, has been lost.

Auxiliary Engines.—Another important application of Diesel engines was to the four-masted ship *Quevilly*, constructed for French owners, and fitted with two sets of 300 horse-power M. A. N. engines as auxiliaries. This ship is of about 6000 tons displacement, and will undoubtedly be the forerunner of many others of the type; the Diesel engine is so peculiarly suitable as an auxiliary even today, saving towage charges, defeating calms, and having no stand-by losses, while its want of proved reliability is, for this purpose, no disability, as even if deranged for any reason, the safety of the ship is not necessarily imperilled thereby.

Suction Gas Engines.—The use of suction gas appears to have made less progress than was at one time expected, the leading example built during the year being the *Holzapfel I.* a ship of 290 tons gross register, built by Eltringham, of South Shields, for the Holzapfel Syndicate. She is fitted with a set of six-cylinder 180 horse-power gas engines, by E. S. Hindley & Co., of Bourton, which transmit their power at 450 revolutions per minute through a Föttinger hydraulic power transformer to the propeller, which runs at a more reasonable number of revolutions. The gas-producing plant was supplied by the Power Gas Corporation, of Stockton-on-Tees. The ship has made a number of coasting voyages, carrying coal, iron, etc., the consumption varying from 25 cwt. to 33 cwt. of coal for the 24 hours. As we have not had an opportunity of making a trip in this boat, we are unable to say how far the difficulties in connection with the variations in the demand on the producer have been met. The only other practical example of the use of suction gas which we have come across

during the year was the *Progress*, an old service boat, fitted with a three-cylinder double-acting two-cycle gas engine, designed by Mr. C. H. T. Alston, which we described last May. We expressed admiration for this engine, particularly for the closeness with which it followed ordinary steam-engine practice, for the compressed air governing arrangement, and the simplicity of the reversing arrangement, which was by a single lever. As we said then, it was only experimental, and the results of the experience gained with it have not yet been embodied in the new engine; but this we shall hope to deal with later. Two or three small installations of suction gas have, however, been carried out in the United States. For instance, the *Mary A. Sharp*, of 66 feet in length, has been in regular service in Chesapeake Bay; she is fitted with a three-cylinder 75 brake horse-power two-cycle engine; with a compression pressure which is claimed to be 135 pounds per square inch; a mean effective pressure of 56.2 pounds has been obtained at 300 revolutions per minute, the consumption of coal being about 1.3 pound per indicated horse-power per hour; the total weight of the plant is said to be 205 pounds per brake horse-power.

Work in Hand.—With regard to continental marine work generally, apart from the *Quevilly*, the *Romagna*, and innumerable submarine engines which have been built for the French, German, Italian and other governments, there is not a great deal to report as to actual results, though, as will have been gathered from our series of articles in December, an enormous amount of work is in progress, such as the *Woermann* liner, which is to have twin-screw, double-acting engines of 2400 combined horse-power, one set built by the M. A. N., and the other by Messrs. Blohm & Voss; the Hamburg-South American liner, which is having her twin-screw machinery built by Sulzer; *La France*, a huge sailing ship, which is having auxiliary engines built by Schneider's; the oil-tank 1100 horse-power ships being engined by the Nederlandsche Fabriek; the *Selandia* and her sisters, to have twin-screw Burmeister & Wain engines of 1250 horse-power each, for the East Asiatic Oil Company; and the twin-screw 4000-ton oil tankers for the German Petroleum Company, which are to have engines of 750 horse-power each, built by Frerich & Co. under license from Professor Junker, and two 9400-ton ships under construction by the same builders with 3300 combined horse-power Junker engines. Truly a good list, though admittedly very incomplete, but it should make a busy year. In this country interest will be centered on the 800 horse-power four-cylinder two-cycle Carels-Westgarth engine under construction by Richardsons, Westgarth & Co. for a 3000-ton capacity ship, and the eight-cylinder sets of four-cycle 2500 combined horse-power engines being built by Barclay, Curle & Co. Something definite should also shortly be known as to the Diesel-turbine combination which is on order for destroyer purposes at Thornycroft's. Nothing will probably be known for some time as to what Vickers are doing on a large scale for cruiser work, nor are we likely to have details as to the submarine Diesel engines which they are turning out, but much has been and is being done in this direction, details of which we are content not to endeavor to make capital out of.

The Line of Progress.—So much for history and anticipations; let us see what tendencies are indicated by, and what conclusions can be drawn from, such knowledge as has been made public. Experience has, to our mind, clearly proved that, as was only to be expected, the internal combustion engine has not yet reached the point of equivalent reliability with steam; little derangements have occurred and are to be expected to occur for some time yet, which only emphasize the demand for the utmost accessibility of all parts, and the wisdom of the policy of fitting twin-screws in all open-sea craft. This latter point, also for the present, assists in meeting the difficulty as to the smallness of the power units which have reached a commercial basis. As regards the economy or otherwise of the internal combustion engine as compared with that of the steam engine, we must admit that up to the present we have seen no figures which can be considered in any way conclusive one way or the other, though many

have been published, all, or nearly all, based not upon experience, but upon estimates, in which the personal element is bound to have an undue influence, as is indicated by the fact that both forms of power have been proved to the satisfaction of their supporters to be the most economical. Reliable figures in this connection should, however, be obtained when the *Furness* boat which Richardsons, Westgarth & Co. are engining has been at work for some time, as she is similar to a number of other ships fitted with steam machinery belonging to the same firm, and will run on exactly the same service, so that the comparison will be an exactly fair one as far as running costs are concerned, and a figure will be obtained for cost of carriage per ton per mile, which is the conclusive figure. Even thus, however, the capital charges will not be entirely satisfactory, as the first cost of the Diesel engine is bound for the present to be very much higher than will be the case when more experience has been gained in its construction. Maintenance and fuel charges, too, are likely to decrease considerably for the Diesel engine as time goes on, and further improvements are introduced, while steam is getting nearer the end of its tether in this direction.

As to the use of the two-cycle or the four-cycle engine, we do not think it is fair to say that the advantage has been proved to lie definitely with one or the other, though the majority of builders apparently prefer the two-cycle—largely, no doubt, on account of the lower cost per horse-power and the larger powers which can be built with present-day knowledge of the heat difficulties. As to general features of design, the consensus of opinion among builders is almost unanimous in favor of the crosshead type of engine rather than the trunk piston, except for naval purposes, where weight and lack of head room call for the latter. How far this is due to the recognition of the prejudice which undoubtedly exists among sea-going engineers in favor of what they are accustomed to, it is hard to say, but it is hardly likely that mere sentiment would be allowed to exert a great influence in a direction which leads to a considerably more expensive, heavier and higher type of engine, and we are of opinion that the arguments used by Mr. J. T. Milton in his paper before the Institution of Naval Architects last spring are sound, and are the real determining factors; at the same time, as we have said on other occasions, we think that these prejudices are worthy of the closest consideration.

Reversing and Transmitting.—With regard to reversing, we think that where it is decided that the best method of going astern is that the engine itself shall be capable of being started and run in either direction, compressed air has proved itself not to be open to serious defects to the extent at one time feared; in fact, from our own observations of numerous cases, although made only under trial trip conditions, it would certainly appear very fairly to meet the requirements of the case. Again, however, it can hardly be said as yet that it has been definitely proved that a reversing engine is the best method of going astern if the intermediate stages—that is, the slow and very slow speeds—are also considered as a part of the problem. Certain it is, that this is a factor which calls for very early and very careful attention at the present moment; it has by no means been satisfactorily solved. Various transmission systems, such as the Föttinger, Hele-Shaw, and Manly Hydraulic, the Mavor and Coulson, and Durtnall electric, and others, have been suggested and submitted in some degree to practical tests. They are designed, of course, to give not only the reverse, but any intermediate speed from maximum to zero, while the engine continues to run at an efficient speed. Such tests as have been made, however, have not been so arranged as to give full scope to the possibilities presented, which allow of the motive power being divided into a number of separate units, all delivering into the transmitter or transformer, and each of these units being run at all times at approximately its maximum efficiency, one or more of the units being, as a rule, entirely stopped, depending on the amount of power required at a given time. Until some such experiments have been carried out, allowing for loss of efficiency in the transmission and giving credit for increased efficiency in propeller and motors, any argument must be purely hypothetical.

Deck Auxiliaries, Governing, etc.—The difficulty of driving the deck auxiliaries has not yet been satisfactorily solved, though experiments in the use of exhaust gases for producing steam in a donkey boiler are about to be made in more than one case, such as the boats under construction by the Nederlandsche Fabriek and the Hamburg-South American boats; the boiler is heated by an oil burner when in port, and this may prove to be the solution. Certainly, if for nothing else, it looks as if the heating of the ships would force steam to the front for the winches and whistle. With regard to the steering gear, we have already mentioned the possibilities of the Hele-Shaw hydraulic electric arrangement, described in a paper before the Naval Architects; further experience which is now being gained with this gear on the S. S. *Arama* should give more definite indication as to its value. Electric lighting would, of course, be obtained by a small internal combustion engine. Whatever the ultimate solution of the whole question of driving the auxiliaries, a solution is of great and growing importance in view of the increase in the sizes of ships to which internal combustion engines are being fitted. With regard to governing, we see no reason to depart from the opinions expressed in our leader of February 24 last year, though the matter must to a large extent remain one of opinion till such time as actual ocean tests have been made with internal combustion engines of sufficiently large size to enable a definite conclusion to be reached. The double-acting engine has not yet received a great deal of attention; indeed, it may be said that, with the exception of one firm on the Continent, the difficulties involved are being simply "funked," and yet it is perfectly obvious that it must come. Will the superintending engineer, for instance, be content to stand idly by while there exists a chance of nearly halving the cost, weight and space per horse-power, of his motive power, even at the risk of some initial mechanical difficulties.

Finally, as to the possible maximum horse-power which can be obtained on a single shaft with present-day knowledge; though a single engine of 1250 horse-power has actually run and given its power, while one of 2000 horse-power is under construction, and though rumor says that a three-cylinder engine of 6000 horse-power has run and run well, it is, in our opinion, hardly probable that an order for a reversible marine engine of more than 500 horse-power per cylinder could be placed today as a commercial proposition, and under any sort of guarantee that the superintending engineer might reasonably ask for.—*The Engineer.*

DEVELOPMENTS IN MARINE PROPULSION.—In reviewing the progress of marine engineering in the course of his presidential address at the Cleveland Institute of Engineers, Mr. H. Stonewall Jackson had naturally something to say regarding the internal combustion engine, particularly as his firm, Messrs. Richardsons, Westgarth & Co., Limited, are manufacturing engines of the Diesel type of 1000 horse-power for a 3200-ton vessel. He stated that although the weight of fuel used will be 60 per cent less, the cost will be about the same; but the saving in weight of fuel carried on a 30-day voyage will be about 270 tons, and to this extent the vessel, on the same draft and displacement, will have increased cargo capacity. In addition, there will be the saving in weight of the machinery, bunkers, etc., equal to about 70 tons, and a reduction in the engine-room staff equivalent to about £150 per annum. These estimates naturally justify a wider consideration, if not a more liberal attitude, on the part of builders and owners as to the potentialities of the system. At the present time there are two sea-going vessels in service with crude-oil engines. One is the *Vulcanus*, with a cargo capacity of 1000 tons on a 10-foot 2-inch draft, built at Amsterdam, and fitted with a six-cylinder, four-cycle, single-acting engine of 500 brake horse-power when running at 180 revolutions per minute. On a voyage from Rotterdam to Stockholm, a distance of 735 nautical miles, the time occupied, when fully laden with 1000 tons of cargo, was 100 hours, the

maximum speed being 8½ knots, and the consumption 1 ton of crude oil per 100 miles. The estimated saving over coal and steam engines is given as 50 per cent, without taking into consideration the reduction in *personnel* charges and the increase in cargo capacity. The other vessel is the *Toiler*, but by Messrs. Swan, Hunter and Wigham Richardson, Limited, of 2650 tons cargo capacity on a 14-foot draft. She has two Diesel engines, each of 180 brake horse-power, built by a Swedish firm. The results given by Mr. Jackson in this case apply to the first voyage from the Tyne to Calais, when the speed was 6¾ knots, and the consumption 1¾ tons of Texas oil per 24 hours, equal to a consumption of about 6d. per mile run with a full cargo of 2700 tons. There are also a large number of small vessels in use, all establishing the practicability of the system, while twelve sea-going vessels are now being built to be propelled with oil engines. Some data were also given relating to the application of coal-gas engines—notably in the *Holzapfel I*, a vessel 120 feet long, carrying 300 tons on a draft of 10 feet. This vessel, which has two producers, each of 100 horse-power capacity, and an engine with Föttinger reversing gear, attained a speed of 7½ knots. The actual consumption of fuel in the first seven voyages varied from 25 cwt. to 33 cwt. of coal per twenty-four hours when the vessel was carrying cargo varying from 242 to 340 tons. The initial cost of the engines and plant is slightly in excess of that for steam engines and boilers, but the saving in fuel—given as from 40 per cent to 60 per cent—compensates for the additional prime cost. The vessel uses anthracite coal in her producer, but many engineers are working at the problem of designing a producer which will use ordinary bituminous coal without the necessity of a gas-scrubbing plant. It is understood that Mr. Holzapfel proposes to construct a new vessel of large size utilizing the experience already gained in practice. Mr. Jackson had much to say also in favor of the use of liquid fuel in marine boilers, and gave the increase in calorific value as 75 per cent in weight over coal. Generally, the address contained much information regarding recent developments, notably in connection with the condenser problem.—*The Engineer.*

MARINE OIL ENGINES OR TURBINES: A COMPARISON.—A recent announcement in the various papers, to the effect that a torpedo-boat destroyer, presumably of some 20,000 shaft horse-power, is now building, and is to be fitted with a combination of steam turbines and reciprocating oil engines of the Diesel type, marks what is decidedly a new stage in the development of the marine engine for high-speed work.

The steam turbine and the heavy oil engine are progressing together, and each has been developing on its own lines for a not very different length of time. Undoubtedly the turbine has supplanted the reciprocating steam engine for high-speed work, and it is quite possible that in the near future its sphere of utility will be extended to even the slow-going tramp steamers.

The two predominant questions which are now arising are:

(1) Can the development of the Diesel marine engine proceed to such an extent as to supplant the turbine in its present premier position for large and high-powered installations—*e. g.*, liners and warships?

(2) Can it (starting, as it does, on practically equal terms) outstrip the turbine in the race for popularity in the future problem of the propulsion of merchant vessels?

Then years ago the marine reciprocating steam engine had passed through such stages of evolution as to be regarded, to all appearances, as nearly as perfect a piece of mechanism as was possible to produce. With the exception of details, the chief strides seem to have been made in its infancy. The rise of pressure from slightly above the atmosphere to 200 pounds per square inch, and sometimes even higher, and consequent on this the recognition of the higher efficiency to be gained by utilizing to a higher degree the expansive property of the steam in the compound and triple-expansion engines, all took place within a comparatively short space of

time. Concurrently with this development was the natural and necessary evolution of the boiler, from the old, flat-sided iron boxes of the "atmospheric" period to the modern cylindrical boiler, and, last of all, to that marvel of lightness and strength, the water-tube boiler.

During the last ten or fifteen years the development of the water-tube boiler has been accompanied by the surprising and extraordinary evolution of the turbine, and as far back as 1904 it was easily seen that, as far as high speeds were concerned, the reciprocating engine was doomed.

A few of the reasons of the success of the turbine may be noted for purposes of comparison: (I) Its extreme simplicity and the absence of working parts. (II) It deals with steam at a far lower pressure than is possible in a "steam engine." (III) There is a considerable economy at high speeds. (IV) Its lightness and the comparatively small space occupied. (V) The initial pressure is comparatively low (170 pounds per square inch). (VI) Smaller staff required than for an equally powerful set of reciprocating engines. (VII) Absence of vibration, and the presence of water is not likely to have such an injurious effect as is the case in an ordinary steam cylinder.

There are, of course, against this, certain disadvantages, the chief of which are: (a) Loss of economy at low powers and the consequent introduction of cruising turbines. (b) Inability to go "astern" and the consequent introduction of separate astern turbines. (c) The necessity for a considerable increase in the capacities of various auxiliary engines to obtain the necessary high vacua. (d) With direct-coupled turbines and propellers the propeller speed is too high, and the turbine speed too low, for each to be working in the most efficient way.

An observation of an Entropy diagram of a set of reciprocating engines reveals the fact that the high-pressure cylinder is very efficient, whilst, owing to the limited expansion, the efficiency of the low-pressure cylinder shows a lamentable falling off.

On the other hand, owing to short blade heights and comparatively large leakage past the blade tips, a turbine somewhat lacks in efficiency at the high-pressure end, but on account of the very complete expansion of the steam, the low-pressure turbine is extremely economical.

Some distinct advantage may therefore be obtained in the matter of economy by using a high-pressure reciprocating engine in conjunction with a low-pressure turbine. This method has been employed with success in several cases.

Realizing the importance of improving the performance of the horse-power end of the reaction turbine, Parsons has now introduced an impulse stage, instead of the first reaction stage, with the advantage that a considerable drop of pressure takes place in the nozzles, followed by constant pressure through the stage of impulse blading, with little, or no tip leakage. This also enables the Parsons' turbine to cope with the coming demand for a moderate superheat.

In addition to this, an inspection of patent specifications will show that the "impulse" turbine, of which the "Curtis" is perhaps the best example, is undergoing considerable modification. In this turbine the last, or low-pressure nozzle stages have been done away with and a "drum" stage substituted. It is claimed that this "drum" stage is still a series of impulse stages, the fixed blades acting as nozzles. This is, however, doubtful, and it is quite possible that under the somewhat problematical condition of the low-pressure steam, the action is similar to that in a reaction turbine.

Thus with the Parsons' turbine modifying its horse-power end of the "Curtis" form, and the Curtis turbine modifying its low-pressure end to the "Parsons" form, it seems to point that in the near future the two types will merge and produce a "standard" marine turbine, the horse-power being of the "impulse" and the low pressure being of the reaction type.

Looking ahead, we will assume such a "standard" turbine fitted in a large ship such as a liner or battleship. Can such an installation be beaten by an "oil engine?" As regards economy "Yes," but as a practical fitting "No," and for the same reason that such vessels still burn coal. There is not enough oil fuel available.

Now turn to small, fast-running craft, which can burn oil fuel alone. It is more difficult to give a direct answer, owing to the greater thermal efficiency of the Diesel engine. Still, no *simpler* or more easily managed installment can at present be imagined than one consisting of a set of "standard" turbines supplied with steam from oil-fired boilers. The question of auxiliaries is also of paramount importance.

However, in both the above cases—*i. e.*, the large ship burning coal and oil, and the small ship burning oil alone—the introduction of an oil engine to the propelling machinery appears to have considerable advantages, especially in the matter of "astern" working, and the development of steam generation for low-pressure turbines, by means of the exhaust gases, would be watched with interest.

Coming now to the merchant class of steamer, having few auxiliaries, here the oil engine should have an exceptionally profitable field to work, as all the elements for success are present with the exception of cost of fuel. These elements are:

(1) High thermal efficiency.

(2) The question of weight is not of great importance.

(3) Greater radius of action or increased cargo capacity.

(4) We have an engine running at a low speed of revolution, thus securing both an engine and a propeller, each running at a speed conducive to high efficiency, without the obvious disadvantages of intermediate gearing, whether spur gearing, hydraulic or electrical. In such a ship the steam necessary for the production of fresh water, etc., could quite easily be generated by the waste heat in the exhaust.

In conclusion, it is perhaps unnecessary to add that *the* mechanism to which all engineers are looking forward, but which seems still in the far distance, is the gas or oil turbine.—*Marine Engineering and Naval Architect.*

GROWTH IN SIZE OF THE TURBINE.—The application of the turbine to marine propellers commenced in 1897, at a period when the efficiency of the new prime mover had been well established. The famous little *Turbinia* of 1897, 100 feet in length, which was driven at 32.75 knots by turbines of 2300 horse-power, showed a steam consumption per shaft horse-power per hour, for all purposes, of 15 pounds. In 1905 the cruiser *Amethyst* was driven by turbines of 14,000 horse-power at a speed of 23.63 knots, with a steam consumption of 16.6 pounds per shaft horse-power per hour for all purposes, and in 1907 the *Mauretania* and *Lusitania*, with turbines of 74,000 horse-power, made 26 knots, with a steam consumption, for all purposes, of 14.4 pounds per shaft horse-power.—*Scientific American.*

THE CARELS DIESEL MARINE ENGINE.—This oil engine has been brought to its present sound and reliable design by Messrs. Carels Frères, of Ghent, after several years of scientific investigation and practical experiment. It is of the two-stroke single-acting type, and is capable of burning the heaviest oils on an economical consumption.

The engine resembles closely in general appearance the standard form of mercantile marine steam engine; indeed, the lower parts may be said to be identical with the same, and therefore need no description. The cylinders also resemble those of a steam engine in the manner in which they are carried on the columns, and in having the inner barrel or liner a separate casting inserted into the outer barrel or jacket. Near the bottom of the liner there is a series of circumferential ports, matching corresponding ports of the jacket casting, which open into a belt sur-

rounding the cylinder. On this belt a branch or facing is formed, to which is bolted the exhaust main, the whole being designed to provide the freest possible exit for the products of combustion. As a precaution against any possible leakage of exhaust gas past the piston into the engine-room, a stuffing-box, packed with metallic rings, is fitted at the bottom end of the liner. A lantern-ring in the middle of this stuffing-box communicates with a circular chamber connected to the suction of the scavenging pump, by which means any escape of exhaust gas into the engine-room is rendered practically impossible.

The piston itself is packed with spring rings of the Ramsbottom type, and is water cooled, the water being circulated through the hollow piston rod by means of walking pipes, or by a pump worked from the crosshead. Ample water-cooling spaces are provided between the liner and jacket of the cylinder, the water being introduced at the bottom and discharged at the top into the cylinder cover. This cover is a strong jacketed casting, jointed and bolted to the cylinder in the usual manner, and carrying all the valves necessary for the operation of the cycle. In each cover there are four scavenging valves, which open simultaneously and admit a column of air, which effectually clears out the residue products of combustion. The fuel-oil injection valve is placed in the center of the cover, and in front of this is the air starting valve, while at the back there is a spring-loaded relief valve. The various valves are operated through levers actuated by cams carried on a shaft, which is supported by bearings bracketed to the cylinder jacket. The drive to this cam shaft is transmitted from the crank shaft by means of a vertical shaft and spiral gear wheels at the center of the engine.

The high-pressure air for injection of the fuel oil is obtained from a multiple-stage air-compressor coupled to the forward end of the main crank shaft. The scavenging and injection air discharges are distributed to the cylinders by suitable mains. The fuel-oil measuring pumps are driven by the cam shaft, and one pump is provided for each cylinder. The quantity of oil discharged can be regulated by hand from the starting platform, while an independent governor control is also provided. The circulating water pump is conveniently driven by the levers operating the scavenging pumps, which, in addition, are utilized for working the bilge and sanitary pumps, as in accepted steam practice. Lubrication is by gravity or ring, except to the pistons, for which a forced system is provided, the pressure being maintained by a pump.

Coming now to the method of operating and controlling the engine, the following description will enable this to be understood: The cams for operating the scavenging valves are of symmetrical form, and can be set to the correct position for ahead or astern running by altering the angular relationship of the cam and crank shafts. The partial rotation of the cam shaft required to bring this about is effected by raising or lowering the vertical driving shaft, which, by engagement of the spiral gear wheels, causes the cam shaft to revolve through the desired angle, the crank shaft, of course, remaining stationary. The movement of the vertical shaft is produced by a servo-motor operating through a rack and pinion and connecting rod coupled to a lever embracing a sleeve on the vertical shaft, the whole arrangement being such that in either extreme position the gear is practically self locking. The piston of the servo-motor is operated by compressed air, and smoothness of action is ensured by the addition of an oil-brake cylinder.

The cams for the fuel injection and air starting valves of each cylinder are in duplicate, there being one set for ahead and one set for astern running. By means of a special auxiliary or maneuvering shaft, parallel with and adjacent to the cam shaft, the rollers of the valve levers are brought into contact with the appropriate cams in the following manner (assuming the engine is about to be started in the astern direction after having been running ahead). In the "stop" position of the maneuvering gear the rollers are all clear of the cams. Thus the maneuvering shaft is

free to slide axially in order to bring the rollers opposite the astern cams. This longitudinal movement is effected by the servo-motor at the same time as the cam shaft is rotated. The maneuvering shaft is then rotated by means of a geared hand wheel, thereby causing the rollers to be brought into contact with the cams.

The details of the mechanism cannot conveniently be described without fuller drawings, but it may be said that by the interposition of specially shaped auxiliary cams on the maneuvering shaft the air starting valves on all cylinders are first brought into action and then gradually cut out and the fuel-injection valves switched in, all this being effected by turning a hand wheel at the starting platform. This same maneuvering shaft brings the measuring pumps into action at the appropriate times, and, finally, when the engine is set to "full speed" position, cuts off the air supply to the starting valves through a regulating valve on the main, thus preventing any possible leakage.

The control mechanism on the starting platform is arranged as follows: The larger and lower of the two vertical hand wheels is the hand reversing gear, which takes the place of the servo-motor should this be out of action. Below this wheel the air cylinder of the servo-motor can be distinguished, while above it is the maneuvering hand wheel. The vertical hand lever carried on the maneuvering wheel bracket operates a cock admitting air to the servo-motor. By the manipulation of this lever and hand wheel the engine can be started, stopped, and reversed at pleasure. The small hand wheel, in an inclined position above the maneuvering wheel, sets the governor for the desired speed of engine, while the quadrant and lever immediately underneath provide an independent hand adjustment of the measuring pumps. All the essential controls are interlocked, so that it is impossible to operate them in any but the correct sequence when stopping and reversing.—*Engineering.*

ELECTRIC PROPULSION OF SHIPS.—At a joint meeting of the Boston Society of Civil Engineers and the Boston sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers held on December 20, Mr. W. L. R. Emmet, of the General Electric Company, Schenectady, N. Y., delivered an illustrated lecture upon the electric propulsion of ships. The speaker reiterated his well-known views upon the subject and emphasized the importance of securing trial installations in large ships, which offer the most attractive savings under operation by electric motors. The general advantages of the motor drive for high-powered propellers were reviewed, including a substantial reduction in the strains upon shafts, certainty of decreased fuel consumption through increase in prime-mover efficiency, extension of cruising radius and diminution in the weight of boilers, machinery and fuel to be carried.

Mr. Emmet contended that the engineering problem of ship propulsion by electric motors supplied with energy from turbo-generators is beset by no serious difficulties. The conservatism of large ship builders and governmental officers appears to be the chief obstacle to the early appliciation of a representative electrical installation on the large scale necessary for a striking demonstration of economy. It appears certain that when such an installation is made it will be done at a great decrease in initial cost as well as accompanied by radical reductions in operating expense. After several years of sustained effort permission has been secured from the United States Government to equip the 20,000-ton collier *Jupiter* with electrical propulsion machinery, and, although delays are being experienced on account of the scarcity of suitable labor, the construction of the ship is now under way at the Mare Island Navy Yard. The *Jupiter* will be equipped with 7000 horse-power in induction-motor propeller drives, the speed of the vessel being 14 knots. The equipment will weigh only 145 tons and will be located practically on the ship's bottom. It is expected that power will be delivered at the shaft with a steam consumption

of 12 pounds per horse-power hour. It will be impossible for the turbo-generator to deliver much more current upon short-circuit than the full-load current of the propeller motors. The apparatus is simple in the extreme. The turbine speed will be about 2000 revolutions per minute, which is high enough to enable the full economy of the turbine to be realized.

Taking up the problem of direct propeller driving of turbines, Mr. Emmet said that this involves speeds below the most efficient range of the prime movers, resulting in a great increase in size and cost, as well as a larger fuel consumption. The mechanical difficulties of driving propellers of large ships through gearing are very serious. In very small vessels gear drives may be reasonably successful, but in meeting the power demands of battleships and trans-Atlantic liners the gearing problem is one of almost insuperable difficulty. High turbine speed is the secret of economical operation, and this can only be positively secured under present conditions by the electric motor drive. The weight of the 6800 horse-power triple-expansion engines of the similar collier *Cyclops* is 335 tons, or more than twice the weight of the propulsive equipment of the *Jupiter*, and the steam consumption of the former is probably about 14½ pounds per shaft horse-power hour, or nearly 21 per cent more than is expected in the case of the electrically driven ship. For the same power the *Jupiter* turbine will weigh but one-tenth that of the direct-connected propeller turbines used on the *Lusitania*. The latter deliver 30,000 horse-power and are obliged to run at the low speed of 180 revolutions per minute, which prohibits securing the legitimate economy of this type of prime mover.

The speaker showed that the electrical equipment of a 17,000 horse-power liner built to run at 17.5 knots would save the owner $20,000 a year in fuel alone, without allowing for any reduction in boiler weight. In the trans-Atlantic service this would enable the vessel to carry 900 tons additional cargo. The estimated steam consumptions were 14½ pounds with quadruple-expansion engines and 11 pounds with the turbo-electric drive. The cost of installing the latter would be at least $50,000 less than the bare expense of the engines. The labor cost of operating large marine engines is also far greater than the expense of handling the turbo-electric equipment. So great is the fuel saving possible with the electric drive that it is estimated that the battleship *Wyoming*, if electrically propelled could travel at cruising speed two-thirds of the distance around the world with a single coaling. The details of auxiliary apparatus in connection with electric propulsion are being carefully developed, special attention having been given to the successful production of a form of salt-water-cooled resistance capable of absorbing large amounts of energy in connection with the reversal of the driving machinery. Over 350 kilowatts have been absorbed by such an apparatus incased in a cylinder about 12 inches high and 6 inches in diameter. The speaker stated that as soon as the electrical equipment is completed at the factory it will be subjected to economy tests in which the conditions of propeller service will be to a large extent duplicated. Preliminary engineering analyses and many former turbine tests indicate that a great field for electrical service is close at hand.—*Electrical World.*

CRUDE-OIL FUEL IN THE FRENCH NAVY.—The French Navy Department is taking measures towards using petroleum residues more extensively in the future for heating marine boilers, owing to the advantages which are now so well recognized as coming from the oil fuel. This is one of the indications which show that the question of substituting oil for coal is occupying the attention of different countries. Oil is likely to be largely used in the future either for burning under boilers, or for operating the new Diesel and other crude-oil engines which are now being made in units of increasing size. As regards the use of oil residues in the French Navy, the late Minister of the Marine, Admiral Boué de Lapeyrère, is quite in favor of it, and a number of plans are now being promoted which will lead to a more extensive use of this fuel. It is now recognized that it

will be of great use in the navy owing to the greater speed and ease in taking fuel on board the vessels, and the greater radius of action which a boat will have owing to the greater amount of fuel represented as heat-giving power, which can be taken in the available given space.

All the new torpedo destroyers of the navy are installed for firing the boilers with "mazout" or petroleum residues of European origin. Up to the present the French seaports were not well equipped for handling and storing the oil, so that the cost per ton was very high and much more than in other leading countries. Measures are now being taken to organize more modern methods for handling the oil in the leading French ports, so that this country will be one of the foremost in this field. At the military ports such as Toulon, Brest and Cherbourg are now being installed great oil reservoirs in which the petroleum residue will henceforth be stored up, and besides this a very complete system is being organized, as the navy has purchased a steamer to be used specially for oil transport. It will ship the oil at the Roumanian port of Constanza in the Mediterranean region, which is one of the leading shipping centers for this product, and will then bring the mazout to the French ports and fill up the reservoirs directly, without the extra handling which heretofore brought up the cost to £6 9s. per (long) ton, while it will be now reduced to £2 14s. per ton. The new steamer has been named the *Rhone*, and it gauges 7000 tons. It is also of interest to note that the 26,000-ton battleships *Courbet* and *Jean Bart* of the French fleet, as well as the new units which are to be constructed, will be fitted with the necessary appliances so that they can burn crude oil or residues at the same time as coal, making thus a combination system.—*Scientific American.*

MISCELLANEOUS.

CHANGES IN ADMIRALTY CHARTS.—Notice is given that on and after January 1, 1912, true bearings will be introduced as soon as practicable in all British Admiralty publications. Details of the new system are as follows:

(a) *On Charts.*—A new pattern compass is already being gradually introduced which enables true bearings to be laid off on the chart, in addition to magnetic bearings as at present. The compass consists of two graduated circles, clearly separated from each other. The outer circle is a true compass, graduated from 0 degree (true north) to 360 degrees, measured clockwise. The inner circle is a magnetic compass, graduated in points and degrees from 0 degree to 90 degrees as heretofore. The bearings of leading and clearing marks, etc., will be given both true and magnetic, and a note to this effect will be placed on the title of the charts. As examples the following are interesting. The bearing S. 40 degrees W. true, with a variation of 12 degrees E. will be shown thus: 220 degrees (S. 28 degrees W. mag.).

(b) *In Sailing Directions.*—Bearings will be given as true only, in degrees from 0 degree (N.) to 360 degrees, measured clockwise; and a note to this effect will be given in the title page, in the advertisement, and in the page immediately preceding page 1 of all volumes of sailing directions. The variations will continue to be given on each map as at present, so the magnetic bearings may be obtained when required. This alteration will be introduced gradually.

(c) *In Notices to Mariners.*—All bearings will be given both true and magnetic in a similar manner to that adopted on charts, the necessary alteration being made in the heading of the notices.

(d) *Lists of Lights.*—Bearings will be given as true only, in degrees from 0 degree (N.) to 360 degrees, measured clockwise. On each page of the Lists of Lights in which this alteration has been carried out a footnote will be placed stating that all bearings are true from seaward.—*The Marine Engineer and Naval Architect.*

DETERMINATION OF POSITION IN FOG.—The U. S. N. Hydrographic Office has just made known the results of important experiments from the cruiser *Washington,* off Nantucket lightship, last September, made for the purpose of determining in a fog the distance between a ship and a lightship or shore station. Knowing that wireless telegraph waves travel almost instantaneously within short distances, while the sound from a submerged bell or an aerial whistle takes an appreciable and definite time to travel a certain distance, the experimenters were able by the aid of chronometers to fairly approximate the actual distance of the cruiser from Nantucket lightship, when the wireless signal, the whistle and the submerged bell all signalled at precisely the same moment. Thus, if the bell signal reached the cruiser nine seconds later than the wire signal, given at the same time, it was easy to calculate the distance from the lightship, allowing 4794 feet per second as the velocity of sound in water.—*The Marine Engineer and Naval Architect.*

SHIPS' BOATS DURING ACTION.—Discussion in respect to the disposal of the boats of a fleet before going into action, has been exercising the minds of certain writers in the press, and divers means have been suggested as to the best time and the best methods for ships out to meet the enemy, to divest themselves of these inconvenient appendages while engaging the enemy. So far as we can see, there is only one practical method of ensuring that boats are not in the way, or are not a standing danger to the crew of a warship as firewood or material to shower splinters around, when search is being made for the enemy. This method is to leave all but one or two on board each fighting ship, at the base from which the ships start, and set those one or two adrift the moment an enemy is sighted; as to do this with a couple of light boats would take but little time. If the weather was smooth enough the auxiliaries, repair and mother ships accompanying a battle fleet might take the boats in tow during an action, and restore them to their respective vessels when the large ships again met their auxiliaries, or came back from the fighting line for boats to carry out humane duties among the beaten ships of their cruisers. If the weather was too rough for this, then the only boats for use of the fleet would be those carried by the auxiliaries, which had not been in the fighting line to get their boats injured, and for this purpose as many boats as convenient should be carried by fleet auxiliaries during a naval campaign. That at least is a practical plan.—*United Service Gazette.*

EVOLUTION OF NAVAL VICTUALLING.—The navy appears to be gradually approaching the period when, as fore-shadowed in the report of the Login Committee, there will be general messes in all ships and establishments, and such canteens as are required will be run by the Admiralty. This is known as the "all navy" system, and is asked for by the men in their annual "Magna Charta," the profits from the canteen to be used as a naval benevolent fund, administered by Admiralty representatives, and representatives chosen from the lower deck by the men themselves. Naturally there has been a good deal of opposition to, and criticism of, such a scheme; since there are vested interests, to which we have more than once hinted, which would be seriously upset. Meantime the Admiralty have had reason to draw the attention of the commanding officers of the navy to the fact that canteen contractors introduce and sell inferior brands of articles at standard prices, fixed for the best class of goods; and to instruct those responsible to see that such cases are reported to the Admiralty, so that the contractors concerned may be dealt with from Whitehall if necessary. The system set up by the Login Committee provides a Scrutiny Committee in each ship, composed of officers and men whose duty it is to see that no fraud of this sort is perpetrated; but like the old Canteen Committees, which they replaced, these committees are

evidently not doing their work as they ought to do, and the men are consequently exposed to unfair tricks by the contractors.—*United Service Gazette.*

TO MAKE SHIPS UNSINKABLE.—Some far-reaching results are looked forward to by the inventors of the new compressed air device for keeping ships afloat after damage by grounding or collision which is being tried in certain battleships of the American Navy. The invention is based on the same principle that has enabled the Arbuckle Wrecking Co. to keep many damaged ships afloat, and in brief it provides that when a vessel has been holed, the water can be driven out by compressed air, "thus permitting the holes to be repaired from within." But it is not stated in the reports at present to hand how this is done; presumably the men sent to do the repairs would be provided with suitable helmets to enable them to work satisfactorily at the greater air pressure, which must, of course, be maintained until the breach in the ship's hull has been closed. A test of the system was made recently in the *North Carolina* by permission of the Navy Department. The seacocks were opened and one of the watertight compartments flooded, and then compressed air at a pressure of 12 pounds to the square inch was forced into the compartment through a small opening. In ten minutes all the water had been forced back into the river. It was necessary, during the time the pressure was being applied to the flooded compartment, to force compressed air at a pressure of 7 pounds to the square inch into all the adjoining compartments, and at a pressure of 3 pounds into those next to the latter, in order to prevent buckling. The captain of the *North Carolina* is reported to have declared that a method had now been found for the first time of making ships practically unsinkable, and for affixing repairs to the hull below the waterline from the inside, either after collision or during a naval battle. To equip a vessel with the system the necessary pipes and gauges have only to be attached to the compressed air plant which every ship at present carries for blowing off poisonous gases and the like. Further experiments are being made in the new battleship *Utah*, the outcome of which will be awaited with interest.—*Army and Navy Gazette.*

THE HYPOSCOPE.—A general on the field of battle wants to see without getting shot. So also does an artillery commander. The enemy naturally take the opposite view, and in these days of long-range weapons and telescopes any staff which shows on a hilltop at once finds itself a target for infantry, artillery, and machine guns. Foreign armies are therefore beginning to issue portable observing ladders to artillery and to general officers. However, even the observing ladder is not altogether satisfactory; the general cannot be expected to go up it himself, and if set up so as to give a wide field of vision it is difficult to conceal from all points of view. It is now suggested, in some quarters, that the hyposcope is better than the ladder. This instrument is a long telescope with a binocular eyepiece in the center and an object glass at each end. It can be used straight, when it gives great stereoscopic effect, or can be doubled up so that the two arms project upwards. These arms can be drawn out to a length of 6 feet, or in large instruments to 12 feet, so as to give a view over the top of a hill, while the tripod mounting supports the eyepiece at the height of the eye. A large instrument has to be heavy in order to prevent vibration in the wind, but it is pointed out that the observing ladder requires a cart, or, at least, a pack aminal to transport it, whereas the hyposcope is lighter than the ladder. At any rate, it will be easier for an elderly general to look through the hyposcope than to climb a ladder or to go up in a balloon.—*Army and Navy Gazette.*

WRECK OF THE "MAINE."—The President sent to Congress on December 14 the report of the Vreeland board on the wreck of the *Maine*. The President's message was as follows:

To the Senate and House of Representatives:

A board of naval officers, of which Admiral Vreeland was the senior member and of which Colonel William M. Black, of the corps of engineers of the army, was also a member, by order of the Secretary of the Navy, was convened at Habana on November 20, 1911, to inspect the wreck of the *Maine* and make a report thereon.

The board finds that the injuries to the bottom of the *Maine*, as described in the report, were caused by the explosion of a charge of a low form of explosion exterior to the ship between frames 28 and 31, strake B, port side. This resulted in igniting and exploding the contents of the 6-inch reserve magazine, A-14-M, said contents including a large quantity of black powder. The more or less complete explosion of the contents of the remaining forward magazines followed. The magazine explosions resulted in the destruction of the vessel.

I have the honor to transmit herewith the full text of the report.

The White House, Dec. 14, 1911. WM. H. TAFT.

The findings of this board were as follows:

38. The port garboard strake between 27½ and 31 was dished upward along its outboard edge as much as 24 inches from a straight line between 27½ and 31, the dish disappearing about 31. At a buttstrap in this garboard strake midway between frames 30 and 31 the after plate and strap were found pulled away from the forward plate and upward fully 6 inches farther than the after end of the forward plate, having been torn loose from the flat keel plate by parting the rivets on the seam between 30½ and 31.

39. B strake was reinforced for its entire length by a continuous longitudinal. This B plate parted the rivets along its inboard seam from 30½ forward to 27½, across the buttstrap at 27½ and aft along its outboard seam to 28.

40. The next plate outboard, C strake, was torn irregularly from 28 inboard to 29 outboard and parted the rivets along the outboard seam as far aft as frame 33, remaining attached to B strake along its inboard seam from frame 28 aft. This plating, formed of B and C plates, as just described, an area of approximately 100 squart feet, wos displaced upward, inward, and to starboard through approximately 180 degrees, having swung about an axis from about 30½ inboard and forward to about 31½ outboard and aft.

41. The transverse floor plates between the outer skin plating, above described, and the inner bottom plating were crumpled. The part of the inner bottom plating directly over this section of outside plating was displaced inward and aft and crumbled in numerous folds.

42. The longitudinal directly over the center of B plate parted its fastenings, broke about frame 28, was twisted, the forward end was displaced upward, and left approximately 6 feet above its original position.

43. The board finds that the injuries to the bottom of the *Maine*, above described, were caused by the explosion of a charge of a low form of explosive exterior to the ship between frames 28 and 31, strake B, port side. This resulted in igniting and exploding the contents of the 6-inch reserve magazine, A-14-M, said contents including a large quantity of black powder. The more or less complete explosion of the contents of the remaining forward magazines followed. The magazine explosions resulted in the destruction of the vessel.

C. E. VREELAND,
Rear-Admiral, U. S. N., Senior Member.
R. M. WATT,
Chief Constructor, U. S. N., Member.
W. M. BLACK,
Colonel, Corps Engrs., U. S. A., Member.
JOSEPH STRAUSS,
Commander, U. S. N., Member.
C. F. HUGHES,
Commander, U. S. N., Member and Recorder.

—*Army and Navy Register.*

THE "MAINE" ONCE MORE AFLOAT.—The second week in February the wooden bulkhead which has been built across the forward end of the unwrecked portion of the *Maine* being completed, sufficient water was admitted within the coffer-dam to free the hull from the mud into which it had deeply settled. The *Maine* rode on a fairly even keel, but on account of the removal of heavy weights and particularly of the after-turret with its two 10-inch guns, the hull floated considerably above its normal water-line. —*Scientific American.*

THE PRESENT STATUS OF WIRELESS TELEGRAPHY.—In a lecture recently delivered at Berlin, Count G. von Arco, after outlining the general working of the main parts of radio-telegraphic installation, began their detailed discussion with the consideration of the antenna problem. Vertical antennas which until quite recently were those most generally in use, are carried by huge masts which must assume enormous dimensions whenever long distances are to be spanned. In fact, the problem of long-range radio-telegraphy has long been dependent almost exclusively on the design of antennas. Whether electric waves are transmitted through the air, the earth or both media simultaneously was until recently an open question, though there was strong evidence in favor of the earth transmission theory. However, the systematic work done by Dr. Kiebitz at the instigation of the German Postal Department has now shown the earth as such to be capable of transmitting electric energy to considerable distances, while sufficient receiving energy, even at the greatest distances, may be derived from the earth alone. The Telefunken Company, on the strength of these experiments, has designed many types of earth antennas exerting well-directed effects and apparently preferable in other respects to aerial antennas. The system becomes much more independent of disturbance due to atmospheric discharges and to the interference of other stations. For the rest the electrical behavior of earth antennas is very similar to that of aerial antennas. As regards, next, the modern system of musical "damped" sparks, this has been further improved upon, and the new apparatus, though of simple design, allows the pitch of the sound to be readily altered. The Nauen Experimental Station (near Berlin), which equalled in power and range the two largest Marconi stations (viz., those connecting England with Canada) has recently been raised to an output four times the initial figure. The height of the tower (originally 330 feet) has been doubled, and two new engines and apparatus halls have been fitted up.—*Scientific American.*

WIRELESS WAVES.—In recent tests carried out in Washington, D. C., for the purpose of determining the law of the variation of strength of signal with distance, it was found that over salt water the electrical waves decrease in intensity in proportion to the distance as found by Duddell and Taylor. In addition they are subject to an absorption which varies with the wave length. This is true in general for day transmission. The absorption at night is entirely irregular, varying from zero to the day value, but is on an average much less during winter than in summer. The received antenna currents between two stations with salt water between are proportional to the product of the heights of the sending and receiving antennas and inversely proportional to the wave length, provided the antenna resistances remain constant. These experiments were made with flat-top antenna heights of from thirty to eighty feet and wave lengths of from approximately 1500 to 4000 meters.—*The Navy.*

TRAINING OF MIDSHIPMEN.—*Fewer Ship Changes.*—The Admiralty have had under review the system of the appointment of midshipmen laid down in Admiralty letter issued May, 1910. Experience has shown that the transfer of midshipmen from one ship to another at the end of their first and second years' training, together with the normal changes of ship due to recommissioning, refit, etc., have resulted in the young officers

serving for so short a period in any one ship that their value as an integral part of the ship's complement and their training afloat are apt to be seriously prejudiced. Accordingly, the Admiralty will endeavor to arrange for midshipmen to remain in the ships to which they are appointed until the end of the commission or until they are due for examination for the rank of lieutenant. Midshipmen will be appointed to such ships as are allowed midshipmen by complement so far as the numbers permit, and all appointments will be made by the Admiralty. The procedure whereby appointments to "B" ships are made by commanders-in-chief will be discontinued.

The Admiralty consider it desirable that midshipmen should continue to be lent to the smaller cruisers or destroyers in small numbers and for short periods, and commanders-in-chief are authorized to make arrangements for this whenever a suitable opportunity arises. The midshipmen should be lent only, and should return to their parent ships, and the total period in their three years' service during which they are so lent should not exceed three to four months.—*Army and Navy Gazette.*

THE EDUCATION OF NAVAL OFFICERS.—Mr. Sanders, on behalf of Lord C. Beresford, asked the First Lord of the Admiralty on the 16th inst., whether the system of education for officers inaugurated in 1902 was satisfactory in every particular; whether he was aware that the Admiralty memorandum of 1902 stated that officers having attained the rank of sub-lieutenant, specialization should begin and should be definite and final, that the committee appointed to consider the subject under Admiral Sir Archibald Douglas in 1905 stated that there would be no need for a final division into three branches, that specialization for a period only was necessary; whether the entry of marine officers from outside on the same principle as before the Admiralty memorandum of 1902 had now been determined upon, and, if so, whether he would state how many marine officers had joined under the old system and how many under the new; whether upwards of 1500 cadets and midshipmen had already entered under the new system, of whom each, according to his merits, would have an opportunity of becoming an Admiral of the Fleet or filling the office of First Sea Lord of the Admiralty; and if he would state to the House whether the Admiralty had abolished specialization or whether they had not abolished it, and so make the question clear to those hundreds of families who gave their sons to the service of the country.

Mr. Churchill: The answer to the first part of the question is in the affirmative so far as the main lines of the scheme are concerned, but experience has shown that some modification in details is required. The answer to the second part of the question is in the affirmative. As regards the third part, the direct entry of marine officers has been determined upon as supplementary to the system of common entry, but the scheme of training after entry will be more comprehensive than formerly and will include instruction in naval as well as in military subjects. No marine officers have at present joined under either the old or the new scheme. The answer to the fourth part of the question is in the affirmative. As regards the last part, the policy of the Admiralty has been fully explained in circular letter No. 25 of August 14 last, which states precisely the conditions under which officers will be allowed to specialize. Engineer officers in future will belong to the military branch, and officers who specialize in engineering may or may not remain specialists within that branch throughout their career. As a general rule, officers who join the Royal Marines will remain attached to the corps throughout their whole career.—*United Service Gazette.*

EXHIBITION OF THE AMERICAN RED CROSS SOCIETY.—The American Red Cross desires again to invite attention to the exhibition in connection with the Ninth International Red Cross Conference, which will be held in Washington, D. C., from May 7 to 17, 1912.

The exhibition will be divided into two sections, which will be styled Marie Feodorovna and General. The former is a prize competition, with prizes aggregating 18,000 rubles, or approximately $9000, divided into nine prizes, one of 6000 rubles, approximately $3000; two of 3000 rubles each, and six of 1000 rubles each.

The subjects of this competition are as follows:

(1) A scheme for the removal of wounded from the battlefield with the minimum number of stretcher bearers.

(2) Portable (surgeons') washstands, for use in the field.

(3) The best method of packing dressings for use at first aid and dressing stations.

(4) Wheeled stretchers.

(5) Transport of stretchers on mule back.

(6) Easily folding portable stretchers.

(7) Transport of the wounded between warships and hospital ships, and the coast.

(8) The best method of heating railway cars by a system independent of steam from the locomotive.

(9) The best model of portable Roentgen apparatus, permitting utilization of X-rays on the battlefield and at first aid stations.

The maximum prize will be awarded to the best exhibit, irrespective of the subject, and so on.

The General Exhibit is again divided into two parts; the first will be an exhibition by the various Red Cross Associations of the world. The second will be devoted to exhibits by individuals or business houses of any articles having to do with the amelioration of the sufferings of sick and wounded in war, which are not covered by the Marie Feodorovna Prize Competition for the year. While the American Red Cross will be glad to have any articles pertaining to medical and surgical practice in the field, it is especially anxious to secure a full exhibit relating to preventive measures in campaign. Such articles will be classified as follows:

(1) Apparatus for furnishing good water in the field.

(2) Field apparatus for the disposal of wastes.

(3) Shelter such as portable huts, tents and the like, for hospital purposes.

(4) Transport apparatus (to prevent the suffering of sick and wounded) exclusive of such apparatus as specified for the Marie Feodorovna Prize Competition.

As with the Marie Feodorovna Prize Competition, for this country only articles having the approval of the Central Committee of the American Red Cross will be accepted.

Diplomas will be awarded for exhibits in this section of the exhibition as approved and recommended by the jury.

Further information may be obtained from the Chairman, Exhibition Committee, American Red Cross, Washington, D. C.

It is perhaps to apparatus having to do with prevention of disease in armies that the energies of Americans have been specially directed since the Spanish-American War. Therefore, the last-mentioned section of the exhibition should make an appeal to them.

AVIATION NIGHT SIGNAL.—A night signal of the kind that aviators will need in the future is now being used at the Treptow Observatory, near Berlin, in connection with atmospheric experiments. It consists of a crimson balloon, a little more than three yards in diameter, carrying an electric light in its center and a hygrometer, or instrument for measuring atmospheric changes, attached to a bell. The wires of the electric light are used as the guide rope of the balloon. When the balloon is sent up to a level free of fog, the registering instrument communicates with the bell, and thus the balloon's arrival in clear air is announced to those who are working it from the ground. These balloons are easily visible at night, and can be readily distinguished from other sources of illumination. —*United Service Gazette.*

WAR OFFICE COMPETITION.—A tremendous impetus should be given to aeroplane construction by the War Office competition. The conditions appear to have been drawn up with exceptional skill and taken together they form an exacting proposition which, if the prize money is to be worthily won will call for a considerable improvement upon anything which has been hitherto attained. An important condition is that the machine must carry a live load of 350 pounds in addition to its equipment of instruments, etc., with fuel and oil for 4½ hours. Under these conditions it must fly for 3 hours and maintain an altitude of 4500 feet for 1 hour, the first 1000 feet being attained at the rate of 200 feet a minute, although a rate of rise of 300 feet per minute is specified as desirable. Loaded as described, it must attain a speed of not less than 55 miles per hour in a calm. Among other attributes of great importance from a military point of view is the fitting of an effective silencer and the manipulation of the engine by the pilot alone. Flexibility of speed is very properly to receive attention, and among other conditions of great importance one notes stability and suitability for use in bad weather.—*Page's Weekly.*

SPECIFICATION FOR A MILITARY AEROPLANE.—The following conditions are those required to be fulfilled by a military aeroplane:

(1) Be delivered in a packing case suitable for transport by rail, and not exceeding 32 feet by 9 feet by 9 feet. The case must be fitted with eye-bolts to facilitate handling.

(2) Carry a live load of 350 pounds in addition to its equipment of instruments, etc., with fuel and oil for 4½ hours.

(3) Fly for 3 hours loaded as in Clause 2, and maintain an altitude of 4500 feet for 1 hour, the first 1000 feet being attained at the rate of 200 feet a minute, although a rate of rise of 300 feet per minute is desirable.

(4) Attain a speed of not less than 55 miles per hour in a calm (loaded as in Clause 2).

(5) Plane down to the ground in a calm from not more than 1000 feet with engine stopped, during which time a horizontal distance of not less than 6000 feet must be traversed before touching.

(6) Rise without damage from long grass, clover, or harrowed land in 100 yards in a calm, loaded as in Clause 2.

(7) Land without damage on any cultivated ground, including rough plough, in a calm, loaded as in Clause 2, and pull up within 75 yards of the point at which it first touches the ground when landing on smooth turf in a calm. It must be capable of being steered when running slowly on the ground.

(8) Be capable of change from flying trim to road transport trim, and travel either on its own wheels or on a trolley on the road; width not to exceed 10 feet.

(9) Provide accommodation for a pilot and observer, and the controls must be capable of use either by pilot or observer.

(10) The pilot and observer's view of the country below them to front and flanks must be as open as possible, and they should be shielded from the wind, and able to communicate with one another.

(11) All parts of aeroplane must be strictly interchangeable, like parts with one another and with spares from stock.

(12) The maker shall accurately supply the following particulars, which will be verified by official test:

(a) The horse-power and the speed given on the bench by the engine in a six hours' run.

(b) The engine weight, complete (general arrangement drawing), and whether air or water-cooled.

(c) The intended flying speed.

(d) The gliding angle.

(e) Weight of entire machine.

(f) Fuel consumption per hour at declared horse-power.

(g) Oil consumption per hour at declared horse-power.

(h) Capacity of tanks.
(13) The engine must be capable of being started up by the pilot alone.
(14) Other desirable attributes are:
(a) Stand still with engine running without being held. Engine preferably capable of being started from on board.
(b) Effective silencer fitted to engine.
(c) Strain on pilot as small as possible.
(d) Flexibility of speed; to allow of landings and observations being made at slow speeds if required, while reserving a high acceleration for work in strong winds.
(e) Good glider, with a wide range of safe angles of descent, to allow of choice of landing places in case of engine failure.
(f) It is desirable that the time and number of men required for the change from flying trim to road trim, or packed for transport by rail, and *vice versa*, should be small, and these will be considered in judging the machine. The time for changing from road trim and packed condition to flying trim to include up to the moment of leaving the ground in flight, allowance being made for difficulty in starting engine.
(g) Stability and suitability for use in bad weather and in a wind averaging 25 miles per hour 30 feet from the ground without undue risk to the pilot. Stability in flight is of great importance.
(h) The packing case for rail transport to be easily dismantled and assembled for use, and when dismantled should occupy a small space for storage.—*Engineering*.

THE AEROPLANE IN WAR.—One of the most interesting features of last summer's military maneuvers in France, and also of the conflict in Tripoli, is the lesson they have given of the influence of the aeroplane in war. Briefly, it has been found that it is impossible to conceal any movements from an enemy possessing a force of aeroplanes. The effect of this will be most far reaching, and it is interesting to speculate on the results.

If we assume that two armies are of fairly equal numbers and equally well supplied with information by their aeroplanes, it seems that it is possible for a sort of stalemate to ensue. Normally, one army would attack the other, massing a sufficient number of troops at the decisive point to give it a large numerical superiority there. It is now generally admitted that it is useless to attack, at a given point, an army supplied with modern long-range weapons unless there is a very great numerical superiority at that point. Such massing of troops, however, absolutely depends on keeping the enemy in ignorance of the intended movements, for if they are aware of the number and position of the troops moved, they can equally well mass troops for the defence. It seems quite possible, therefore, that neither side could dare to take decisive action. It is, however, not the least likely that any two armies would be equally well supplied with information by their aeroplane corps. Just as one army is usually able to penetrate or force back the cavalry screen of the other, and to obtain valuable information, so one army, by dint of superior forces of airmen, or by greater daring, will generally be better supplied with information than the other, and will have a proportionate advantage.

It is, however, quite possible, in fact probable, that the matter may go much further than this. It appears to be assumed by many writers that each side will allow the other to use aeroplanes for reconnoitring purposes without any opposition, save that which can be offered by shooting at them from the earth. This, however, is to ignore all the teaching of history. The art of war lies greatly in anticipating the enemy's movements, either by intuition or by obtaining information, and also in leading him to form incorrect opinions as to the *locus* of the attack to be made on him. Wellington said that he had spent his military life in guessing what was happening on the other side of the hill. The principles of strategy are constant, and it is certain that no commander can ever hope for success who tamely views his opponent inspecting his lines and makes no

effort to frustrate him. Just as every battle has hitherto been preceded with skirmishes of outposts, followed by an artillery duel, so in the future there will be fights in the air before the men on the ground come into contact. The side with the greatest force of aeroplanes will never let an enemy's machine fly over their own position without sending a superior force of aeroplanes to capture or destroy it. As defeat in the air means certain death, it may be presumed that in many cases surrender would be preferred, and in this case a very short time would see one side in possession of complete command of the air, and therefore able to get all the information it required without allowing the enemy to get any.

This might in itself render even a very large army perfectly helpless, as every endeavor to advance would only lead it into carefully prepared positions. On the other hand, the smaller army could always find out the weak points to attack. If the numerical superiority of the enemy were too great for attack to be made at all, stalemate might result; but it must be remembered that huge armies cannot be kept in the field indefinitely, owing to the enormous expense, and to the fact that calling out all the reserves means the withdrawal of the workmen from the various productive industries of the country. Unless such an army can attack, it must be eventually disbanded, and peace made on the best terms obtainable.

While this is all we may, perhaps, expect at the present time, the rapid progress of the aeroplane makes it interesting to speculate on the results of an equally rapid increase in its efficiency in the future. The money hitherto expended in constructing aeroplanes has been measured in thousands, but if this were increased to a very few millions, it is quite possible that in the near future aerial fleets capable of carrying several thousand men with light guns and a supply of explosives could be produced. In the face of such a force any army without aeroplanes would be useless, for it would be unable to keep up its communications. In fact, it would be unable even to protect its base. The aerial fleet could roam about the country at will destroying the railways, telegraphs, and other means of communication. The recent railway strike has shown us what the interruption of railway communication means even for a few days, and it is quite certain that a very short spell of it would reduce any country to making peace.

It is of the utmost importance that we should thoroughly appreciate the importance of these points. Owing to the smallness of our population, and the fact that we do not have conscription, it is quite impossible for us to keep up a huge army as do the Continental powers. We have hitherto kept command of the sea, and it is now becoming equally important to have complete command of the air. It is therefore high time that we determined that we will do so, and that, however many aeroplanes any other power builds, we will build more, just as we do with the ships. Further, that however many men any other power trains to flying; we will train more. We have plenty of men who would make as good, or better, flying men than any if it were made worth their while; but we must have a really good government school and flying ground, and reasonably good pay must be given. It is also necessary that constructors should be encouraged to put up factories in England at which aeroplanes can be turned out in numbers, to provide for the wastage of war.

We therefore welcome, as a preliminary to more important developments, the fact that the War Office have published the conditions of a competition for aeroplanes, to be held about the middle of next year. As we have already said, it is undoubtedly high time that something was done to encourage military aviation in this country, and we are therefore very glad that this competition has been decided upon.

A list of the prizes offered, and a statement of the conditions of the competition, are printed on page 840 of the present issue, and it is unnecessary, therefore, to repeat them here. Taking them all round, these conditions appear very fair. It is, however, to be regretted that more money is not being spent on prizes for British-made machines, and that

there appears to be no encouragement to the use of British engines. It is just as important that we should build our military aeroplanes in this country as our fighting ships, and therefore the sooner a substantial amount of money is spent on fostering the industry the better.

With regard to the technical conditions there appears to be little fault to find. There are, however, several points which may entail a good deal of modification in existing machines. Thus it is not at all certain that the landing chassis of the ordinary aeroplane will comply with the conditions laid down as to alighting and starting on rough ground. There is no doubt that in this matter many machines are capable of a great deal of improvement. We have before commented on this and on the very small wheels generally fitted. If the standard wheels will not comply with the conditions, however, it seems likely that the principal alteration required will be an increase in the size of the wheels, or some modification of the skids.

The requirement that the aeroplane shall carry two persons, and that it shall be capable of being controlled by either, may necessitate some modification of existing machines, but this will not be great. The condition that the view of the country should be as open as possible both to the pilot and to the observer may not be easy to fulfil in some types, especially when taken in conjunction with the stipulation that the men are to be shielded from the wind. The usual position occupied by the pilot in a monoplane complies with the latter condition very well, but not altogether with the former. On the other hand, the position of the pilot at the front edge of the front plane in a biplane affords an excellent view, but exposes him to the wind. It appears possible that the best view of any would be obtained from a monoplane with the wings set out about a foot from the body. The increased stress due to this would be very small, and the view in every direction very good. There may, of course, be some practical objection to this plan, but it seems worth a trial.

If the condition that the engine must be capable of being started by the pilot alone means that he must be able to set it in rotation without assistance in holding the aeroplane, it implies either some form of anchorage or else brakes sufficient to prevent the machine from moving. Possibly the latter will be necessary to ensure stopping in the space specified. There does not seem to be any theoretical difficulty in fitting brakes to hold the machine with the engine running. If it be preferred not to have these, it would be quite easy to arrange for an anchorage with a trip-gear to release the aeroplane when required.

While there appears to be little to criticize in the conditions, it is perhaps a pity that a definite date for the competition was not announced, so that competitors should know exactly when their machines are to be ready. There is also no indication of what relative importance will be attached to the various points. Probably this is wise, as it leaves the committee a freer hand in their awards, and it is only by experience that the relative importance of different features can be ascertained.—*Engineering.*

ANNUAL REPORT OF THE SECRETARY AND TREASURER OF THE U. S. NAVAL INSTITUTE.

ANNAPOLIS, MD., March 16, 1912.

TO THE OFFICERS AND MEMBERS OF THE INSTITUTE:

Gentlemen:—I have the honor to submit the following report for the year ending December 31, 1911.

On Feb. 23, 1912, the Board of Control decided that the accounts of the Institute should be audited at the earliest convenient date by a firm of public accountants.

Black & Company, of Baltimore, were awarded this contract, and completed their work on March 15, 1912. In place of the report being submitted in the usual form, their report in full is published:

BALTIMORE, MARYLAND, March 12, 1912.

TO THE OFFICERS AND MEMBERS OF THE UNITED STATES NAVAL INSTITUTE, ANNAPOLIS, MARYLAND:

Gentlemen.—In accordance with instructions from your Secretary and Treasurer, Lieut.-Commander Ralph Earle, U. S. N., under date of March 6, 1912, we have made an exhaustive examination of the records, books of account, etc., of the

UNITED STATES NAVAL INSTITUTE, ANNAPOLIS, MARYLAND,

for the year ended December 30, 1911, and herewith submit *certified balance sheet* as of December 30, 1911, together with the following exhibits:

Exhibit A.—Cash account.
Exhibit B.—Investments (bonds).
Exhibit C.—Statement of cash receipts and disbursements.
Exhibit D.—Operations for the year ended December 30, 1911.
Exhibit E.—Trial balance, December 30, 1911.

Our investigation has been very thorough and complete, including an examination for the entire year of all checks and vouchers covering the cash disbursements; proving all additions in cash book and ledgers; checking all postings into ledgers, and verification of cash, securities and surplus accounts. We were unable to verify the $164.25, consisting of checks, money orders and cash in safe in office, as of December 30, 1911, as our examination did not begin until March 8; but we did count the actual cash, etc., as of February 9, 1912, and found it to agree with cash-book balance.

As a result of our examination we have made some verbal recommendations which will, we think, greatly facilitate the work of your office and

enable statements to be set up showing the actual condition of your Institute. We would also make the following suggestions:

First.—That *all* cash receipts be deposited in bank, and *all* cash disbursements be made by check; and, if it is found necessary to make any payments in cash, to provide your cashier with a petty cash fund out of which payments can be made, receipts taken and periodical reimbursement made to him.

Second.—That the outstanding check #634 of $2.00 which we are advised has been lost, be taken up as a cash receipt, and that the error of $.01 be treated in a like manner.

Third.—That the difference, between the estimated marked value of the bonds owned by your Institute and the valuation as per the books, be charged off.

The general condition of the books of account, records, etc., of your Institute, is such, as to merit commendation; and we acknowledge, with thanks, the uniform courtesy shown us and the cheerful assistance rendered us by your office force while we have been engaged in making this examination.

Respectfully submitted,
BLACK & COMPANY,
By Wilmer Black, C. P. A.
Certified Public Accountants.

UNITED STATES NAVAL INSTITUTE, ANNAPOLIS, MD.

BALANCE SHEET, DECEMBER 30, 1911.

ASSETS.

Cash (Exhibit A)		$12,601.66	
Investments (Exhibit B)		46,097.67	
Accounts receivable		2,809.36	
Accrued interest		112.50	
Inventory		2,700.00	
Furniture and fixtures		300.00	

LIABILITIES.

Accounts payable			$ 1,255.09
Reserve fund			6,753.14
Balance January 1, 1911	$ 6,663.14		
Transferred from General Fund	90.00		
Surplus			56,612.96
Balance January 1, 1911	$56,432.57		
Net Profit for year ended December 30, 1911. (See Exhibit D)	180.39		
		$64,621.19	$64,621.19

We hereby certify that the above *balance sheet* is a true and correct exhibit of the condition of the *United States Naval Institute, Annapolis, Maryland,* as of *December 30, 1911,* as disclosed by the books of account.

BLACK & COMPANY,
By Wilmer Black, C. P. A.
Certified Public Accountants.

Dated at Baltimore, Maryland, March 12, 1912.

EXHIBIT A.

CASH ACCOUNT, DECEMBER 30, 1911.

Seaman's Bank for Savings, New York City...			$ 3,000.00
Balance, as per letter dated March 2, 1912...		$3,000.00	
Rhode Island Hospital Trust Co., Providence, R. I.			2,929.40
Balance, as per letter dated March 12, 1912...		2,929.40	
Society for Savings, Hartford, Conn.....			2,913.94
Balance, as per letter dated March 12, 1912...		2,972.20	
Interest not taken up until after Jan. 1, 1912..		58.26	
		$2,913.94	
Farmers' National Bank, Annapolis, Md.....			3,594.07
Balance, as per balanced bank pass book, balanced February 6, 1912.....		$4,840.99	
Less Deposits.			
January 12, 1912.....	$ 830.13		
Draft	67.67		
January 11, 1912.....	132.95		
January 25, 1912.....	328.22		
February 6, 1912.....	1,445.99		
		2,804.96	
		$2,036.03	
Add Checks drawn in 1912.			
#897	$ 9.21		
898	87.50		
899	70.20		
900	49.00		
902	40.00		
903	160.00		
904	1,248.14		
905	.95		
906	6.00		
907	75.00		
908	50.00		
909	87.50		
		1,883.50	
		$3,919.53	
(Checks #901, 910 and 911 still out.)			
Less Outstanding Checks.			
#634	$ 2.00		
810	12.00		
815	5.00		
868	170.40		
873	136.00		
		325.40	
		$3,594.13	
Less.			
Error of Bank (over).....	$ .01		
Error Jones check #736.....	.05		
		.06	
		$3,594.07	
In Safe in Office.			
Checks		$ 67.71	
Money Orders		9.19	
Cash		87.35	
			164.25
			$12,601.66

EXHIBIT B.

SECURITIES (BONDS) DECEMBER 30, 1911.

Face value of bonds.	Name of company.	Amount as per books.	Estimated market value.
$ 6,000.00	Southern Railway 6–$1000 5% Registered Gold Bonds.	$ 6,745.14	$ 6,432.00
2,000.00	Washington Railway & Electric Co. 2–$1000 4% 50 yr. Gold Bonds Consolidated Mortgage.	1,715.00	1,720.00
18,000.00	Northern Pacific & Great Northern R. R. 8–$1000 Joint Bonds Registered. 2–$5000 C. B. & O. Collateral Registered.	17,718.83	17,460.00
2,000.00	Potomac Electric Power Co. 2–$1000 1st Mortgage 5%.	2,115.00	2,030.00
9,000.00	Northern Pacific Railway. 4–$1000 3% Registered Gold Bonds. 1–$5000 3% Registered Gold Bond. General Lien due January, 2047.	8,902.45	6,120.00
9,000.00	B. & O. R. R. Co. 1–$5000 1st Mortgage 4% 50 year Gold Registered. 1–$1000 1st Mortgage 4% 50 year Gold Registered. 3–$1000 Prior Lien 3½% due 1925.	8,901.25	8,842.50
$46,000.00		$46,097.67	$42,604.50

EXHIBIT C.

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED DECEMBER 30, 1911.

Balance, January 1, 1911		$16,823.52
RECEIPTS.		
Dues	$ 1,934.63	
Subscriptions	1,251.53	
Sale of Books	24,280.62	
Sale of Proceedings	73.84	
Advertisements	849.27	
Interest on Investments	2,235.01	
Postage	16.37	
Binding	37.12	
Life Membership Fee	60.00	
Rebate on Insurance	71.50	
Sundries	43.03	
Total Receipts	$30,852.92	30,852.92
		$47,676.44
Balance, January 1, 1912		$12,601.66

DISBURSEMENTS.

Printing and Binding Proceedings	$ 4,196.11
Printing and Binding Extra Publications	13,392.51
Salaries	3,250.00
Contributors	2,533.05
Authors of Text-Books (Royalties)	4,483.20
Postage and Telegrams	583.51
Expressage, freight and hauling	85.53
Purchase of Books for Sale	835.67
Office Expenses—Stationery, supplies, etc.	220.92
Foreign Copyright and Royalties	117.41
"War on the Sea," "Genius of Naval Warfare."	
Prize Essay Award	213.95
Honorable Mention Award	180.00
Purchase Northern Pacific & Great Northern R. R. Bonds	4,815.69
Refunds	10.28
Rent of Safe Deposit Box	5.00
Engraving Prize Essay Medal and Case	10.75
Subscription to Magazines	8.32
Subscription to Naval Directory	1.10
Purchase of back numbers of Proceedings	11.00
Insurance on Institute Property	80.00
Attorney's Fee	40.00
Discount on drafts	.77
Total Disbursements	$35,074.78
Balance, December 30, 1911 (Exhibit A)	12,601.66
	$47,676.44

EXHIBIT D.

OPERATIONS FOR THE YEAR ENDED DECEMBER 30, 1911.

Inventory, January 1, 1911.			
Back numbers of Proceedings	$ 200.00		
Extra Publications	1,000.00		
		$ 1,200.00	
Purchases.			
Books for Sale	$ 835.67		
Back numbers of Proceedings	11.00		
		846.67	
Printing and Binding Proceedings	$ 4,500.28		
Printing Extra Publications	13,392.51		
		17,892.79	
		$19,939.46	
Inventory, December 30, 1911.			
Back numbers of Proceedings	$ 200.00		
Extra Publications	2,500.00		
		2,700.00	
Cost of *Publications* sold		$17,239.46	$17,239.46
Profit on *Sale* of *Publications*			6,016.14
			$23,255.60

EXPENSES.		
Postage and Telegrams	$ 567.14	
Expressage, freight and hauling	84.03	
Exchange	.32	
Insurance	8.50	
Contributors	2,533.05	
Salaries	3,250.00	
Authors of books (Royalties)	4,483.20	
Office Expenses (stationery, supplies, etc.)	227.87	
Foreign Copyright and Royalties	117.42	
"War on the Sea," "Genius of Naval Warfare.		
Transferred to Reserve Fund	90.00	
Prize Essay Award	213.95	
Honorable Mention Award	180.00	
Refunds	10.28	
Attorney's Fee	40.00	
Rent of Safe Deposit Box	5.00	
Engraving Prize Essay Medal and Case	10.75	
Subscription to Magazines	8.32	
Subscription to Naval Directory	1.10	
Total Expenses	$11,830.93	$11,830.93
Net Profit		180.39
		$12,011.32
Sale of Books	$23,164.69	
Sale of Proceedings	90.91	
Total Sale of Publications	$23,255.60	$23,255.60
Profit on Sale of Publications		$ 6,016.14
Dues	$ 1,847.81	
Subscriptions	1,255.53	
Advertisements	525.50	
Interest on Investments	2,235.01	
Bindings	30.25	
Sundries	41.08	
Life Membership Fee	60.00	
	$ 5,995.18	5,995.18
		$12,011.32

EXHIBIT E.

TRIAL BALANCE, DECEMBER 30, 1911.

Cash	$12,601.66	
Investments	46,097.67	
Reserve Fund		$ 6,663.14
Surplus		56,432.57
Dues		1,841.81
Subscriptions		1,255.53
Sale of Books		23,164.69
Sale of Proceedings		90.91
Advertisements		525.50
Interest on Investments		2,235.01
Postage	556.14	
Binding		30.25
Expressage	82.68	
Sundries		41.08

EXHIBIT E.—Continued.

Exchange	$ .32	
Life Membership Fees		$ 60.00
Cash in exchange for checks		6.73
Insurance	8.50	
Printing and Binding Proceedings	4,500.28	
Printing Extra Publications	13,392.51	
Contributors	2,533.05	
Salaries	3,250.00	
Authors of Books	4,483.20	
Telegrams	11.00	
Purchase of Books for Sale	835.67	
Stationery	155.89	
Purchase of Drafts	124.15	
Freight and Hauling	1.35	
Prize Essay Award	213.95	
Honorable Mention Award	180.00	
Rapid Addressing Machine Co.	41.75	
Rebates	10.28	
Office Expense	15.03	
Stenographer and Typewriting	15.20	
Rent of Safe Deposit Box	5.00	
Engraving Prize Essay Medal and Case	10.75	
Subscription to Magazines	8.32	
Subscription to Naval Directory	1.10	
Purchase of Back Numbers of Proceedings	11.00	
Attorney's Fee	40.00	
Accounts Receivable	2,809.36	
Accrued Interest	112.50	
Inventory December 30, 1911	1,200.00	
Furniture and Fixtures	300.00	
Accounts Payable		1,255.09
	$93,608.31	$93,608.31

The second suggestion made by this firm has been carried out. The first and third suggestions are under consideration.

The investments, hitherto carried at price paid for them including brokerage, will, if carried at market value of December last, show an apparent decrease in the surplus of $3,493.13.

The actual net gain during the year has been therefore $180.39.

A change, suggested by the accountants, has been made in the method of bookkeeping which simplifies, in a measure, the work connected therewith, and enables quickly a balance to be struck and a full report to be rendered of operations at any time that it is desired.

Respectfully,

RALPH EARLE,
Lieut.-Commander, U. S. Navy,
Secretary and Treasurer.

BOOK NOTICES.

"The United States Navy." A hand book, by Henry Williams, Naval Constructor, U. S. Navy. New York: Henry Holt & Co., 1911, 228 pages. illustrated with numerous half-tone engravings and line cuts. Price, $1.50.

Naval Constructor Williams, U. S. Navy, from his experience at sea, as well as on shore, is well qualified to write on this subject.

Many of those questions that every person in the naval service has been asked hundreds of times are answered authoritatively and in a non-technical manner.

The book opens with a chapter on Naval History; then follow chapters on The Navy's Organization; Personnel; Man-of-War in Commission; Classes of Ships; High Explosives; Mines; Torpedoes and Aeroplanes; Designing and Building a Warship, Dry Docks, and closes with a chapter on the National Defense.

The information given is accurate and will prove interesting to those who have some interest in the navy.

There is an excellent index, which will undoubtedly increase its value as a reference book.

W. B. WELLS.

"A Manual of International Law"; for the use of naval officers, by Rear-Admiral C. H. Stockton, U. S. N. Annapolis: Naval Institute, 1911. 313 pp.

The manual before us represents the experience gained in the practice of international law by its author during a long and especially useful career as an officer of the United States Navy; a career which may be said to have culminated in his fortunate incumbency of the office of superintendent of the Naval War College at Newport, Rhode Island. There is no place, certainly in the United States, where instruction in international law is carried on with such systematic thoroughness, or where better or more practical results are obtained, and this is due, in great part, to the intelligent and well-directed endeavors to that end which were put forth by Admiral Stockton, and by Professors Snow and Wilson who cooperated with him in the establishment of the school upon its present basis. A notion of the extent and character of the work done at the War College may be obtained from the annual volumes of its Proceedings—a work of standard and permanent value.

The manual is primarily intended for the use of naval officers, as is indicated by its title. The book is not quite equally divided between peace and war; a comparatively full presentation of the former being necessary in the discussion of the subjects of territory, including boundaries, insurgency in its relation to belligerency, jurisdiction on the high seas and nationality, all of which are of the first importance to officers of the navy. In the portion devoted to war, belligerency, neutrality, maritime capture,

blockade, contraband, the right of search and unneutral service are all of them thoroughly and lucidly discussed in the light of the most recent authorities. The old rules of maritime capture, which have recently been made the subject of conventional amendment, are brought fully up to date; the most recent of these, the Convention of London of 1907, is treated in great detail and at sufficient length. This is as it should be, for that convention, if generally and fully adopted and followed, is calculated to bring about very material changes in the practice of maritime warfare.

It was an earlier American author, the late Major-General Halleck, whose work on international law was required to be carried on board every public armed vessel in the British Navy. It is fortunate, indeed, that Admiral Stockton's excellent work on the same subject is to occupy a similar place in the navy of the United States. For that purpose a better selection could not possibly have been made.

GEO. B. DAVIS.

(Reprinted from the American Journal of International Law, Washington, D. C., January, 1912.)

LIST OF PRIZE ESSAYS.

1879.

Naval Education. Prize Essay, 1879. By Lieut.-Com. A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880.

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881.

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882.

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut.-Com. F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883.

How may the Sphere of Usefulness of Naval Officers be extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884.

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885.

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886.

What Changes in Organization and Drill are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887.

The Naval Brigade: its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888.

Torpedoes. Prize Essay, 1888. By Lieut.-Com. W. W. Reisinger, U. S. N.

1891.

The Enlistment, Training and Organization of Crews for our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892.

Torpedo-boats: their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894.

The U.S.S. Vesuvius, with Special Reference to her Pneumatic Battery. Prize Essay, 1894. By Lieut.-Com. Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895.

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut.-Com. Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896.

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention, 1896. By Lieutenant John M. Ellicott, U. S. N.

1897.

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

1898.

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut.-Com. Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900.

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901.

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903.

Gunnery in Our Navy. The Causes of its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904.

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905.

American Naval Policy. Prize Essay, 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear-Admiral Stephen B. Luce, U. S. N.

1906.

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut.-Com. A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906. By Pay Inspector J. A. Mudd, U. S. N.

1907.

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A few thoughts on our next step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut.-Comdr. Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908.

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENSE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut.-Commander Yates Stirling, U. S. N.

1909.

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910.

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotten, U. S. N.

1911.

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912.

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut.-Commander T. D. Parker, U. S. N.

NOTICE.

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now enters upon its thirty-eighth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute. by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII.

Sec. 1. The Institute shall consist of regular, life, honorary, and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control, and a vote equal to one-half the number of regular and life members, given by proxy or presence, shall be cast, a majority electing.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control, and, if their report be favorable, the Secretary and Treasurer shall make known the result at the next meeting of the Institute, and a vote shall then be taken, a majority of votes cast by members present electing."

The Proceedings are published quarterly and anyone may subscribe for them. The annual subscription is $3.00; single copies, 75 cents. Annual dues for members and associate members, $2.00. Fee for life membership, $30.00.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1913.

A prize of two hundred dollars, with a gold medal, and a life-membership in the Institute, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1913. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. If, in the opinion of the Board of Control, the best essay presented is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention" or such other distinction as the Board may decide.

5. In case one or more essays receive "Honorable Mention," the writer of the first of them in order of merit will receive seventy-five dollars and a life-membership in the Institute.

6. Any essay not having received honorable mention may be published also, at the discretion of the Board of Control, but only with the consent of the author.

7. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

8. All essays submitted must be either typewritten or copied in a clear and legible hand.

9. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

RALPH EARLE,
Lieut.-Commander, U. S. N., Secretary and Treasurer.

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LIEUTENANT W. B. CUSHING, U. S. NAVY.
AT THE TIME OF THE SINKING OF THE ALBEMARLE.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

Honorable Mention, 1912.

INSPECTION DUTY AT NAVY YARDS.

By LIEUT.-COMMANDER T. D. PARKER, U. S. Navy.

Motto: "Ah, make the most of what we yet may spend."

The writer was once much impressed by what he saw at a factory in an old French town: a friend's negotiations for the purchase of the entire output were incontinently stopped by the arrival from the shops of a dozen new-made knives that the manufacturer felt obliged to count and examine at this precise moment. Two points were made clear: (1) the manufacturer was lost in routine; (2) he needed an inspection department.

A modern navy yard commandant, with his imperative military, social, and industrial duties, has little time for counting knives. In these strenuous times, commandants are busy managers—chained to their desks, despatching their callers, clipping their words, dictating, telephoning, writing, writing . . .

Yet the question is asked—and asked too often to be ignored—whether they need organized inspection departments. Is not each foreman an inspector for his own shop? And does not each head of department report on all work under him? Is not a separate inspection department a troublesome and expensive "overhead"? Many such questions are asked. But—much is lost in military transmission. The voice of the "man behind the job" seldom reaches the commandant, who needs assisting ears and eyes, and more direct information than he gets from those responsible for the work they report on. Moreover, it seems to

the writer that the following advantages make the existence of some organized inspection force highly desirable:

1. Certain standards of quality will be maintained only when the workman knows that each piece of work will surely be inspected.

2. Certain abuses as to costs and charges will be prevented when it is known that a force is on the lookout for them.

3. Certain defects of a larger kind will be corrected if a department is free to investigate them.

4. Certain improvements will be suggested by such a department.

The advantage of having a department with the business of doing these things *and with no other and more pressing business* outweighs all objections.

It may be interesting, for comparison, to note the practice of large civilian plants. Of eight such plants, two have a fully organized inspection corps; four have inspectors for limited kinds of work (such as riveting done at piece-work rates), or for coordinating work, or for covering certain contracts; two depend wholly on foremen. But in nearly all cases these plants have resident inspectors to represent their customers and to see that work in progress is being done in a satisfactory manner. That is just what an inspection department does for the one big customer of navy yards.

It is also interesting to compare the inspection methods of a "scientific" system of management like the Taylor system, as developed for civilian plants. Under this system each shop has its own inspector, who is one of the "functional foremen." The personnel devoted to inspection purposes is therefore much larger relatively than that at any of our navy yards. At the New York yard, for example, the total number of assistants and sub-inspectors (at a recent date) was 13; at the Norfolk yard, 7. An inspector for each shop would require about 22 at New York and 16 at Norfolk, without considering those needed for the inspection of stores (especially ordnance material) and of the great volume of outside work. This point is interesting in a comparison of efficiencies under the two systems; for eight or ten men cannot compete with twenty or thirty. It is important to note with care that the field covered by Mr. Taylor's inspectors is much more limited than that of the inspection department as prescribed in General Order No. 53—and their usefulness cor-

respondingly less. The Taylor inspectors check the quality of work in shops. The navy yard inspector (aided by his force) acts as a sort of outside aid for the commandant, observing and reporting general conditions about the shops and yard. He also acts as a coordinator, watches the progress of work, inspects material in store, and performs various other duties as discussed under "Scope of Inspection Duty" below.

These features will be much less important when the commandant has, subject to his orders, an industrial superintendent (compare the "shop superintendents" of divisional heads) to coordinate the work of the manufacturing divisions and to relieve him of detail—as a medical officer does at the hospital, or a marine officer at the barracks. Is it possible for anyone charged with the large administrative and military duties of a commandant to decide on the mass of technical details that *somebody* must pass on? But—"That is another story." At any rate, the inspector is very necessary in the absence of the organizer and coordinator referred to above. When management has been improved as it cannot be under the present system, the need of an inspection department can come up for discussion again.

Meanwhile, even if a modern system of management is to be introduced, something must be done during the period of transition. If the inspector is to go (and nothing above seems to *force* that conclusion), he will certainly be needed until the substitute is offered. The introduction of a modern system requires, from all accounts, a long time—usually three or four years. The development of "functional foremen," including shop inspectors, is a slow process. During this period of unrest, someone must pass on shop work—and the commandant will need, more than ever, an outside aid, "watch dog," and adviser.

SHOULD INSPECTION BE FROM WITHOUT OR FROM WITHIN?

If an inspection department is needed, the next and very important question is:

Should inspection be from without or from within?—should the inspection department be part of the manufacturing department, or separate and distinct?"

In the words of Sir Roger de Coverley, "There is a great deal to be said on both sides." Looking ahead to a time of improved management, no off-hand answer can be given, however one might advocate the separate department at present. Probably

the inspectors would all pronounce in favor of the separate department even with a Vickers system—the "inspected" mostly against it under any conditions. Disinterested officers of ability have differed broadly on this point. The writer, having convictions of his own, finds it difficult to state the case impartially; but he will attempt to outline both sets of arguments. Since the discussion may be trite, it must be brief.

On the one hand the people *who really know most* about a given piece of work are (usually) those who are doing it. Presumably the master pattern-maker or the master ship-fitter knows more about pattern-making or ship-fitting (at least as regards the job in progress) than any one else in the yard. The best inspections could be made by foremen and their assistants, provided they had time and inclination to make them. Moreover, they make some inspections in self-defence; so that other, outside inspection is often a duplication of work. Particularly, inspection from the outside lacks sympathy and understanding, and may partake of the nature of interference. We have all heard of the wise young officer, full of importance and mathematics, fresh from the academy or college, who criticises what he doesn't understand and drives practical men wild. The chief carpenter or boatswain, who is excellent aboard ship but weak in certain details of shop work, may also *seem* a nuisance when, as a rank outsider, he passes on the work of trained mechanics in another department of the yard.

In certain cases these arguments are certainly valid and "must give us pause." Officers who stand strongly for the good of the service advance them with persistence and sincerity.

On the other hand, the purpose and aim of the department when the last "shake up" occurred was to get, at navy yards as at Washington, criticism of work by officers not responsible for it. General Order 53 begins with the significant words:

"Officers performing inspection duty at navy yards are the representatives of the commandant only."

Provided the inspection department has a proper personnel, there are marked advantages in the detached criticism thus obtained. Will not a member of a manufacturing division use soft words when speaking of "our" work to the head of department? Does not a note of admiration creep in when we criticise ourselves? Can the head of a yard department frankly reveal to

the commandant all the defects of his work, organization, and personnel, without sacrificing his own reputation for efficiency? If he can, does he usually feel that he can? And as to the cases where partial responsibility attaches personally to the "man higher up"—will he always own up freely? Or will a discreet inspector serving under him bring such matters before him? It all comes to what has been strongly said and realized during recent years—"Self-inspection is no inspection."

Moreover, great weight must be given to another feature (referred to above) of the present inspection system—*its directness.* When we allow for what is forgotten, for what is misunderstood, for what is intentionally withheld, and for what is tactfully softened—how much that the workman sees and reports reaches the commandant? How very direct is the chain from the workman (or the work) through the sub-inspector and inspector to the commandant, as compared with: workman—leading man—quarterman—foreman—assistant officer—head of department—commandant. "Seven right-angle elbows equal a blank flange."

The commandant who gets all his criticisms from inspectors reporting through foremen and heads of divisions, or from other subordinates who duly follow the usual channels, will enjoy all the security of the "simple little ostrich" with his head in the sand.

One of the civilian plants referred to above—a large and widely known electrical establishment—maintains two inspection forces, both quite independent of the manufacturing body. The employees of one make mechanical inspections and report to a chief inspector whose decisions are seldom over-ruled. The electrical inspectors make final tests and examinations under a superintendent of tests.

CHARACTERISTICS OF AN EFFICIENT INSPECTION DEPARTMENT.

Accepting the inspection department as it is, we pass on to a vital but less controversial topic: What makes inspection work efficient?

(A) *Personnel.*—The first essential is to get the right men. Inspection departments have usually been composed of a commander or lieutenant-commander, sometimes assisted by a lieutenant, with several warrant assistants, several civilian sub-inspectors (or acting sub-inspectors), and a small clerical force.

As to numbers, this force is usually inadequate to the work assigned—which, as before mentioned, is both broad and long. Comparison has already been made with the large force, covering a much more limited field, called for by the Taylor system. Inspections cannot be efficient until this new department is given a larger personnel or narrower duties. Of course we must use "efficient" as a relative term and "cut the garment to suit the cloth." At one of the northern yards the inspection force has consisted of the inspector and two clerks. It would seem reasonable, however, to adopt as a standard the number of assistants suggested by the Taylor system—one for each shop. Each assistant could keep in constant touch with the work of his shop—and those having less work to overlook would have time for the inspection of stores, scanning of surveys, and other duties discussed elsewhere. In the writer's opinion, the inspector with a smaller force than this must make the soothing declaration: "We'll do the best we can."

As to fitness, it is peculiarly necessary that assistants—whether officers or civilians—should be selected men. Although some warrant officers make excellent inspectors, an *indiscriminate* detail of such officers to this duty means failure. As realized by those who have trained "functional foremen," a special type of man is needed for inspections.

> "Others there are
> Who, trimmed in forms and visages of duty,
> Keep yet their hearts attending on themselves"

—and others still who, while excellent at directing work, are indifferent or unwilling as critics. Such persons are *useleşs* in the inspection department. The man needed has a vague, dull pain when he sees bad work or bad methods; and speaks perforce, even at the sacrifice of his own interests. He must have independence; must prefer efficiency to popularity; and must hate perfunctory shams. Such men can be found. Fortunately civilian sub-inspectors volunteer for the work, and win their appointments by competitive examinations. They also have the advantage (usually) of knowing the yard and the yard personnel. As, moreover, the supply of officers is limited, more civilian sub-inspectors should be appointed. If the inspection department is to be taken seriously in its relation to the hull division, it should surely include a representative of the construction corps. Chief car-

penters do not adequately represent the corps that has been particularly identified with yards and yard work. Would not the detail of a junior construction officer to each inspection department—a step in line with the recent detail of line officers to the hull division—promote a better understanding and decidedly increase the efficiency of the department? The answer seems obvious, unless the inspector is destined always to "make bricks without straw."

Moreover, the close relation between the inspector's work and that of the accounting officer on one hand (as regards charges, costs, etc.) and of the general storekeeper on the other (as regards stores, surveyed material, etc.) makes it desirable that whenever the shortage of pay officers is reduced, a representative of the pay corps should come within the inspector's fold. This need will be more apparent in connection with the discussion of "excessive costs" below.

The medical officer and chaplain may for the present be dispensed with, though questions of hygiene and morals are not wholly beyond the inspector's ken. The civil engineer has inspectors of his own.

(B) *Aims.*—A first impression is that the inspector is detailed as a "yard critic." Better thinking leads to the conclusion that his duties are primarily co-operative. He should be everybody's assistant—not a busy-body, "butting in," consuming time, opposing thought-out plans with hasty ideas of his own, but a patient investigator, an intelligent observer freed from the demands of routine, an aid to the commandant and his departmental heads in pointing out defects and in promoting efforts with which he sympathizes. This attitude will be understood if inspectors will make suggestions to those immediately concerned instead of complaints to higher authority.

Unfortunately they sometimes find it necessary to choose the official channel in order to avoid having legitimate objections or suggestions ignored.

After they have done what they can in a co-operative sense, their critical duties begin. The direct responsibility of the inspector lies here; for, while his other work is largely discretionary, he is required to pass specifically on each job completed, accepting or rejecting it.

It should be noted, however, that the more general duties referred to above are clearly assigned in General Order No. 53

the genesis of the inspection department. Unluckily it is difficult for the inspector to carry out this order, however correct his aims, without seeming to "interfere." Some reserve and tact are obviously necessary, but the only inspector who does not "interfere" *in a helpful way* is the inefficient one whose "good taste" outweighs his sense of duty and respect for orders.

(C) *Scope of Inspection Duty.*—An efficient inspection department must cover the wide field assigned by the above general order. This (as laid down or implied) includes:

(a) Inspection, as to quality, of work in progress or completed.

(b) Criticism of plans for work.

(c) Inspection as to progress of work—with report of delays in starting jobs or of excessive time spent on them.

This feature may be specially helpful to ships.

(d) Inspection of costs—with report of those that are excessive.

(e) Inspection as to shop methods.

(f) By implication—criticism of general yard conditions.

(g) Technical examinations as to condition, etc., of material in store.

For a detailed explanation of the above see "Kinds of Inspection."

Added to this at most yards have been the general supervision of survey work and scanning of survey reports. Though the point is disputed, this seems to the writer proper work for the inspector and closely related to his other duties—*provided his force is correspondingly increased.* It may be disastrous to diffuse the energies of the present inspection personnel. A distinction must be made, however, between the supervision and scanning of surveys, and the actual surveying, which is done by officers detailed from the various departments.

It was also suggested at the conference of commandants that the inspection department should inspect stores purchased for the general storekeeper. A majority voted against this; and such inspections are usually made by the divisions concerned. Although it might be logical to include this in the work of the inspection department, these inspections are wholly different from those for which the department was created, and the present size of the force does not permit this extension of its duties.

(D) *Methods of Inspection.*—The inspector should keep general track of shop and ship work, singling out the larger jobs

for personal observation; and should inspect personally when questions arise between representatives of the manufacturing department on one hand and his assistants, or officers of the ships, on the other. He should be the "assistant chief umpire" for the commandant. He is also the centralizer, digester, and forwarder for his department.

It seems obvious that he should spend at least half his time in the yard and shops; yet for reasons given at length below, it is difficult for him to do even that. Conferences with assistants, interviews with officers of other departments, memoranda, reports, signatures, surveys, bind him to a desk with the same Lilliputian cords that so many others have vainly struggled against. The inspector *must*, however, get a first-hand knowledge of jobs, and should do all in his power to minimize office work. It is hoped that the centralization of offices and of filing systems will help much in this respect. His assistants should be impressed with the fact that *their* work is wholly (or almost wholly) outside. Each should spend seven hours a day in and about the shops.

The distribution of inspection duties should be along the lines of individual fitness. An average inspection force may include a lieutenant, a chief gunner, a chief carpenter, a boatswain, a machinist, and, say, three sub-inspectors, one from the hull division and two from the machinery division.

The lieutenant should have some special assignment (in line with his aptitudes), should have certain authority as a general co-ordinator and assistant; and should be trained to act in the absence of the inspector. Here it may be noted that it does not seem desirable to have the reports of the other assistants go through him, for that throws in just so many ohms to resist the current of information.

The chief gunner, under the inspection officer, would take over many duties of the former ordnance officer. He would spend fully half his time in the ordnance building, directing the work of the general storekeeper's ordnance force, inspecting material, suggesting work needed for its preservation, selecting articles for survey, and probably acting as survey officer for ordnance stores. His technical advice is of value to the general storekeeper and the manufacturing heads. He may also, if qualified, take over electrical inspections, in whole or part, this depending upon what other assistant is available.

The chief carpenter and one sub-inspector would divide most of the hull work between them. In this division of labor the question of individual fitness is important. One plan has been to give the first of these assistants all shop work, the other all ship work; but though this is convenient as a time-saving arrangement, it ignores the principle just referred to. The sub-inspector assigned to ship work may not have a sea-going knowledge of flushing systems, fire mains, drains, etc. The chief carpenter may never have worked in a shop from which the sub-inspector was appointed. It is better to find out the classes of work that each knows most about, and assign jobs without undue regard to location. The use of bicycles will shorten distances immensely, so that an assistant can inspect a ship-fitting job on a ship out of commission and two minutes later go through the blacksmith shop.

The boatswain, though less needed than the others, would have the sail loft, the shipwright's shop, and the rigging loft. He would have additional duties as survey officer for his department.

The machinist and a sub-inspector appointed from the machinery division would divide machinery inspections in the same way that the two assistants referred to above divide hull-division work.

The third sub-inspector, if qualified, would take over all electrical inspections. He should be specially appointed for this duty.

It seems desirable, in some cases, to have two assistants inspect the same piece of work, and each "O. K." the job order. For instance, an anchor engine should be inspected by both carpenter and machinist—each from his own point of view. A fire main might be inspected first by a sub-inspector for mechanical defects; secondly by the carpenter for the suitability of leads from the man-o'-war's-man's standpoint.

It should be borne in mind that the above assignments are suggested with a view to inspection departments as they are, not as (it is thought) they should be.

Each assistant should have an eye to cost, as well as to quality, of output. While keeping track of work in progress, he should note whether it is being done in the right shop, whether the right machine is being used, whether first-class men are engaged on helpers' jobs, whether two gangs are needlessly working at the same job, whether over-expensive material is being used, etc.

The plan has been tried of having an assistant specially detailed for cost investigations. If this is done, he should work in conjunction with the others, who, during their daily rounds, can note faults as indicated above for the special assistant to investigate in detail. With an ideal personnel, the system of having each make his own cost studies might be preferable; but with existing conditions it seems better to have a specialist develop methods, study accounts, and concentrate on this kind of duty, which involves clerical work and lengthy inquiries that would consume too much time of a man whose aptitudes lie differently.

At one yard a sub-inspector was assigned to time and efficiency studies based on modern methods of management.

(E) *Accuracy and Discretion.*—Whatever methods be followed, any criticism—good or bad—of the work of the divisions is likely to be an annoyance to the officers concerned. However broad a busy man may be, he will probably feel nettled at a criticism of his subordinates or a suggestion from an outsider as to improvements in the department *he* is straining to improve. Such suggestions come when he is deep in other matters, and require at best a mental twist. Irritation results if the criticism seems trivial or ill-founded. Therefore the first duty of the inspector is to avoid hasty action through excess of zeal. Unless he wants to be shaken off as a nuisance, he must be tactful, restrained, and judicious. *He must insist on absolute accuracy in himself and from his assistants.* No report should be forwarded until study and discussion have proved the point to be well taken. A slip, even in a small detail, unduly discredits his department, with divisional heads already (perhaps sub-consciously) prejudiced against outside advice, or with commandants who, in the struggle with routine, have scant time to pick truth out of a mass of conflicting endorsements. Let the length of a screw or the name of a nipple be obscurely misstated, and the return endorsement will begin with a prominent "The inspection officer is in error, etc.," that catches the eye of the common superior. Many big truths are killed by small errors. An effective critic should spend hours in studying a case in order to spend minutes in tersely reporting it. Moreover, as commandants and others are so pressed for time, he should select the cases—choosing those that are typical rather than sporadic, so that his report may result in something.

(F) *Subordination of Paper Work.*—Though many reports can be made in person or by telephone, some must be written as a matter of record or for convenient reference. Otherwise, every effort should be made to minimize paper work. The importance of this has been referred to above. The efficiency of the department depends largely upon whether paper is a means to an end, or a perfunctory substitute for something real.

A considerable amount of paper work is unavoidable with the present system as outlined in General Order No. 53. At a large yard a force of three or four clerks—say a chief clerk, a stenographer, a typewriter, and a messenger—are kept pretty constantly busy, especially if they handle surveys. This will be understood if we consider the usual and necessary procedure in the handling of job orders and records. When a job order is issued, duplicate copies are furnished the inspector. One of these goes to the assistant concerned, the other is kept with a record of all matters relating to the inspection. Report is made in writing (sometimes in advance by telephone) when the job is begun and when completed. The report of completion may be made by the foreman's forwarding a *third* copy of the job order with notation to this effect. The assistant inspects the work, and immediately turns in his copy with notes as to acceptance or rejection (with cause), and other matters of interest. The gist of these notes is transcribed on the retained copy and a copy of the notes furnished the accounting officer as authority for closing accounts on the satisfactory jobs.

Other details as to the handling of these papers would be tiresome, and are omitted. It can be seen, however, that with thousands of job orders passing in and out, the clerical work involved is heavy; moreover, if proper records are to be kept, it is hard to say how the work could be much lessened. Probably in time somebody will think of a way.

There is much other necessary clerical work: the filing of job orders, transcribing of letters and memoranda from the inspector, writing of endorsements, correction of errors in the transmission of job orders, answering telephone calls, handling of surveys, and numerous time-consuming details. The handling of copied correspondence is referred to below. Even under intelligent supervision, the force referred to above will be kept constantly busy.

If inspections are to be made understandingly, the office should receive copies of all yard correspondence affecting its work. This correspondence must pass over the inspector's desk and be distributed for the information of the various assistants. No attempt should be made to retain it permanently in a separate inspection office file. Although this handling of copies requires more clerical work, it is highly necessary; for the inspector cannot pass properly on work unless he has seen certain correspondence about it—and mere access to such correspondence helps him little, since he does not know of its existence. Copies should be furnished, looked over, and destroyed. This is in no way inconsistent with the principle of a central filing system. The routing of originals through this office would entail too much delay.

Since such clerical work is necessary, the main thing is that it be done by *clerks*, and as little as possible by the inspection force. As emphatically stated above, a paper inspection department might as well exist on paper only.

Much time is lost by assistants in getting the "O. K." of ship's officers to work done on ships and inspected by these officers as well as by the yard force. This would not be so bad if it were not desirable to make report of inspection *immediately after completion* in order to expedite the making out of invoices. Much hunting and waiting for the ship's officers results. An efficient assistant once told the writer that he spent nearly half his time getting ship's job orders signed up! Of course, this can and should be remedied. Mailing these orders for signature is usually satisfactory, except that it involves delay. The above statement illustrates, however, the danger of clerical non-essentials eating out the heart of inspection work.

(G) *Weekly Conferences.*—A weekly conference of the inspection officer, his assistants, and the chief clerk, with the latter as recorder, gives a fine opportunity for the discussion of general matters.

KINDS OF INSPECTION.

The various kinds of inspection have been enumerated under "Characteristics of an Efficient Inspection Department" above. It is necessary to explain briefly what is meant by each.

1. *Inspections for Quality.*—This is what the inspector is chiefly responsible for. It is his duty to see that these inspections are thoroughly made, and his misdemeanor (in a military sense)

if any defective job is passed. He should secure expert mechanics for his assistants—or lacking these, should do all he can to train the personnel at hand. Carelessness in passing over mechanical defects should be the unforgivable sin. The method of inspection and its closeness must depend upon the extent of ground covered by the assistant. In any case he must check up the work closely enough to feel morally sure that it will serve the purpose in hand. Essential measurements should be checked; pressure tests should be witnessed; castings should be closely examined for blow holes and given an air test when practicable. From heaps of similar articles such as hinges, samples should be taken at random and carefully examined. Comparison should be made with drawings, and work checked for completeness. Forgings should be examined for defective welds. Electrical circuits should be tested; voice tubes talked through; engines tried under steam. In general, it is for the assistant to explain if he affixes his stamp to any piece of work that is not what the job order calls for.

The effect is to make workmen much more careful. It has been said truly that an inspection body is like a police force that makes few arrests but "keeps the lid on." Bad navy yard workmanship isn't common nowadays. The complaints are rather as to over-elaboration, excessive cost, delays, etc.

2. *Plans.*—The study of plans is an important duty of the inspection department—and is sometimes slighted. Each assistant should make routine visits—weekly or preferably daily—to the draughting room, and arrange for the chief draughtsman to have ready new drawings, details of work in progress, etc. The inspector should discuss important undeveloped plans with the draughtsmen and officers who are working on them, and should make timely criticism of defects. Some good has been effected in this way; but a ship seldom leaves the yard after a fitting out or a general overhauling without defects and oversights that inspectors might have noted before a nail was driven or a hole tapped.

When all plans are supervised by *sea-going* officers (whatever their corps), the number of such cases will be fewer.

3. *Prevention of Delays.*—Without any direct authority to regulate the order of work, the inspection department, through reports to the commandant and others, can be a great help to ships by seeing:

(a) That work is begun with all reasonable promptness.

(b) That steps are taken to expedite the delivery of specially needed material.

(c) That towards the end of a vessel's stay jobs are being pushed to completion.

Ship's officers, though best qualified to pass on work when done, are not sufficiently familiar with the methods and personnel of navy yards to push it. They lack facilities for finding out the cause of delays, and information as to the best man to see in each case. Here the inspection people, with their knowledge of the yard and the other work in progress (from which men may perhaps be shifted or material substituted), may co-operate very helpfully.

When a ship arrives for a stay, the inspector should quickly get in touch with her officers to find what is the status of her unfinished jobs and what work is particularly wanted. He should then, after due consideration, report delays in starting work. He also keeps touch with jobs in progress, and notes obstructions due to non-delivery of material or to non-completion of incidental work by another department. If the wait is for material, he takes the matter up with the divisional officers and the general storekeeper. He finds perhaps that the request to the latter was not made as "urgent," or that the general storekeeper has failed to investigate delays in delivery, or that routine instead of emergency methods of purchase have been followed. In any case he can often suggest action (such as the sending of a telegram) that will promptly remedy the trouble. With a scientific system there would be few such delays, and these few would be automatically noted; but at present they often occur. If the trouble is in a wait for incidental work, a report to the divisional heads may result in the necessary action—perhaps overtime or shift work instead of a leisurely eight-hour swing.

At a routine time, towards the end of a vessel's stay, the inspector should call on each assistant for a detailed statement as to the progress of his jobs, and after sufficient investigation should forward these reports in such shape that the commandant or others will see exactly what remedies to apply—overtime on a certain job in the boiler shop, a telegraphic request for conduit, etc. If needed mechanics are employed on less urgent work, specific report should be made. A vague intimation that "the

Oklahoma's repairs may not be finished up," or that "the *Oklahoma's* bridge work is running behind" is of little practical value.

Take a typical case. The "*Alaska*" is to leave the yard in fourteen working days. The inspector orders all her jobs checked up, and receives word that her turret work is behind the schedule. On investigation he finds that the electricians will need six days for their work and cannot do it until the ship-fitters have secured a certain tube in place and the pipe-fitters have run certain conduit; also that some needed wire due ten days ago has not arrived. It turns out further that the ship-fitters are waiting for some angle irons from the blacksmith shop, and that the blacksmith and ship-fitters are both short-handed.

He reports these facts to the commandant, and recommends (after further consultation):

1. That two blacksmiths working on a job for *stock* be put on the angle irons to finish these quickly.

2. That four additional ship-fitters be called (only four are registered), and that overtime work be done to expedite the securing of the tube.

3. That electricians assist pipe-fitters in running conduit.

4. That a telegram be sent requesting immediate delivery of wire—and that if it is still lacking, some *reserved* (but not yet needed) *for the Kearsarge* be used.

While some of these steps might have been taken without the inspector's suggestion, it is unlikely that all would have been. The ship's officers, though uneasy, have not known exactly what to do. The divisional officers and general storekeeper have had various other jobs to think about. The result is, that after a scramble, the last cable is pulled two hours before the *Alaska* sails!

4. *Reports of Excessive Cost.*—The inspector is required to note and report cases of "excessive cost." As already said, these cases may be investigated in two ways—by assistants separately, or by a special investigator acting in conjunction with the others. The subject is a wide one, and can only be outlined here.

A man up a tree might suppose that the accounting officer makes a study of costs. But he doesn't (to any extent) *as yet*. He merely *records* charges that, lacking technical information, he cannot criticise. It is hoped that eventually a system of real cost keeping will be developed for the benefit of the manufacturing

officers. *They*, moreover, occasionally investigate overcharges, and make constant efforts to prevent them. But they are busy *getting work done when needed;* and cannot give the subject the attention it deserves. It therefore devolves upon the inspector to stop the gap and to systematically point out cases of extravagance. With his present force he cannot analyze all charges; but, following the "method of exceptions," he can closely investigate typical overcharges. With the active support of the commandant and the divisional heads, he can thus do much towards increasing yard economy. It would be useless to cite instances showing how much room for improvement there still is.

The nature of these investigations (some of which have been already referred to) may be indicated by the following statement of subjects for cost criticism:

(a) Charging work done on one job to another job. This was formerly a common abuse. Two evils result from it—unauthorized work; and authorized work charged for excessively.

(b) Charging general shop work to specific jobs arbitrarily selected. This is a misleading way of artificially reducing the "overhead."

(c) Disparity between estimated and actual costs. In the present state of estimating this is unimportant; but with an improved system, estimates and costs would mutually check in a valuable way.

(d) Manufacture where purchase would be cheaper (or the reverse). Many cases can be pointed out where purchase should be substituted for manufacture at excessive cost. Occasionally the reverse obtains.

(e) Excessive cost of manufacture as compared with that at (1) other yards, (2) commercial establishments.

(f) Uneconomical shop methods.

(g) Use of wrong class of labor. Sometimes the cost of work is greatly increased by the use of first-class mechanics where helpers would do. Each case has to be studied on its own merits.

(h) Use of too many men. Sometimes two gangs are employed, each in the other's way—or superfluous labor is otherwise used. This may at times be due to the habit of "nursing" jobs caused by our system of labor employment.

(i) Hand work where machine work would be much quicker and cheaper. This may be due to the wish of a foreman to keep work in his own shop.

(j) Use of wrong machine. Loss of economy often results in the same way from the foreman's preferring an unsuitable machine in his shop to a suitable one in another.

(k) Over-elaboration in doing work—or use of too costly material. Work often costs excessively merely because it is too good for the job in hand.

(l) Material drawn for one job (and not needed) used on another. This kills cost accounting, and makes the charge against the first job excessive.

(m) Waste of material. Some of the largest gains claimed in connection with the introduction of "modern management" at the Watertown Arsenal have been in connection with eliminating waste of material.

At two or three of our Eastern yards, frequent cost reports have been made by the inspection department. Although authorities differ as to the proper scope of such inspection duty (one view being that cost study is properly a function of the *manufacturer* aided by the accountant), it is undoubtedly true that the inspector is now charged with it by the department's general order; that no other department now goes at it "hammer and tongs"; and that much alarm has been caused by the cost studies already made. The inspection force has at least served the moral purpose of a "Fleet in Being."

5. *Shop Methods.*—The question of shop methods is woven in with that of costs. This kind of inspection can be made clear by an example.

It was found at a certain yard that when machinery was finished the foreman would issue a shop order on the joiner, "Crate one set of crank brasses," "Make box for one gasoline engine," etc. Investigation disclosed the following facts:

Directions were so vague that the joiner often made expensive boxes where cheap ones would answer.

These expensive boxes were sometimes made when no box was needed—when the material was to travel only a few hundred yards.

New (even finished) planking was used when old packing material was plentiful.

The searchlight was turned on; and these methods were (it is hoped) made obsolete.

As divisional heads are sensitive about shop methods, inspectors should be particularly sure of their facts before suggesting improvements.

6. *Yard Conditions.*—It seems within the spirit, if not the letter, of the oft-quoted General Order No. 53, that the inspector should report on general yard conditions—for instance, an accumulation of old material; a bad arrangement of storehouses; the blocking of a roadway. In many such cases, of course, his report would be made to, or through, the captain of the yard.

7. *Inspection of Stock.*—When the general storekeeper took over all stock, the various departments, still having cognizance of it, advised him as to its care; later, under the Newberry system, the various departmental inspectors did this; now, combining faded glories, the inspection officer makes technical examination of the stock *in all departments.* This is an important duty—for the general storekeeper must rely on him for expert criticism. A routine of weekly and quarterly inspections of stock should be established; and report made of such things as, spruce poles languishing for fresh water; rubber spoiling from too much heat and light; machinery deteriorating for want of white lead and tallow or in need of a jacking over; electrical insulation yielding to moisture. Special attention should be given to surveyed material (see below).

8. *Duties in Connection with Surveys.*—To complete the inspector's honors and titles, he might be called the "Director of Surveys." The handling of surveys should certainly be centralized. The commandant cannot scan them all; his aid has other duties. A clerk can be assigned to the duty of scanning them—in a clerical way. But until the inspector was given this added duty, no one did much more than return reports "for correaction in accordance with Article ———, Navy Regulations"; or request that ensigns be "burned," not "stored"; or sternly demand that "no responsibility," etc., be duly inserted. Technical scanning was practically unknown. If a surveying officer, by mistake or through carelessness, recommended that a new piece of furniture be sold, or that spare parts accidentally separated from the mother machine be scrapped, his mistakes were liable to pass unchallenged.

Some idea of the importance of the survey question may be obtained from the following figures, selected almost at random,

showing the magnitude of survey transactions at a large yard during one quarter (April-June, 1911). The figures are official:

Invoice value of surveyed articles on hand at beginning	588,151.75
Invoice value of surveyed articles received.....	370,434.28
Total	958,586.03
Expended	606,601.24

Where the annual transactions run into millions, it is worth while to have a system of checks.

The following steps tending to the proper handling of surveys should be taken:

(a) Each survey should be looked over, first, by the proper assistant; secondly, by the inspector in person. Reports should be returned for both minor and major corrections. If important changes are then made, the matter should be taken up with the commandant.

(b) A series of memorandum instructions should be issued and copies furnished each surveying officer with a view to standardizing methods of survey.

(c) The inspector should be in touch with the general storekeeper and with the surveying officers regarding all survey matters.

(d) There should be a weekly conference of the inspector with his surveying assistants, who (while usually assigned to other duties) are under his general direction as regards this duty. Such conferences have proved interesting and instructive.

PERSONAL DUTIES OF THE INSPECTOR.

General Duties.—The day's work for the inspector has already been described under another heading. Without repeating, it may be interesting to discuss some special aspects of his duty.

(A) *The Inspector as a Promoter.*—Although the word "promoter" suggests Blackie Daw and his friend Wallingford, it is not used unkindly here. The thoughts of a well-meaning critic turn to remedies. Having discovered these, he may even *urge* them. When the inspector reports a faulty condition, the first and sometimes disconcerting question is: "What do you want to do about it?" After all, the critic who can't answer this question is merely destructive. By a natural extension of his regular duties, the inspector is therefore called on to "find a way." Having proposed a plan, he wishes to see it work, and begins to "push."

Indeed, if any navy yard officer wishes to be effective, he must do much more than suggest. He must drive his points home; follow papers through; secure consideration of his ideas under difficulties. The momentum of the big yard machine makes a gentle suggestion like a twig in the path of a motor car. The inspector-promotor labors under the disadvantage of always having to lug in new business not on the regular calendar. On the other hand, he has ready access to the commandant, and can get approval of his ideas if they are good and if he is persistent. But this isn't all. It is a pipe dream to suppose that "Approved" on a letter or endorsement means "In effect." Orders given in this form are misunderstood, mislaid, forgotten. The inspector must explain, hunt up, remind. His work is only half done when all objections have been removed and approval given. Perfect harmony reigns—but somehow the plan is not working!

But "Look! Listen!": Whatever improvements the inspector advocates, he should invariably make suggestions affecting other departments through, or after consultation with, the officers concerned. Otherwise he may be a great source of danger through real, unwise, interference. The views of the beneficiary should always be obtained.

(B) *The Inspector as Assistant Umpire.*—Where differences of opinion exist between the heads of yard departments, or between divisional and ships' officers, it may be convenient to the commandant to get technical advice from a third, disinterested party, with an investigating staff of his own.

(C) *The Inspector as Special Investigator.*—Many questions as to shop arrangements, methods of accounting, disposition of personnel, etc., are put up to the commandant for decision and involve extensive investigation. It has been found convenient to turn over matters of this kind to the inspector for investigation and report. If thorough, impartial, and judicious, he may thus be very useful in saving time to the commandant. He can get the views of both sides (if there are two), verify, boil down, and digest. Examples of matters thus referred are: Recommendation as to a new method of accounting for target material; request for the installation of a crane; a working arrangement for carpenters carried on the rolls of one division and used by another. *Facts,* conflicting considerations, and recommendations should be presented in each case.

(D) *The Inspector as Handy Billy.*—This discussion would not be complete without reference to another phase of inspection duty. It is natural—yet, it seems, unfortunate—that an officer with the diversified duties described above should be given still others that have no natural connection with his billet. A reason for this is that the yard machinery can always move without him. But the tendency to pick him up for boards, courts-martial, detached duty, and what not, is very demoralizing. The first time an inspection department hardly yet organized came within the writer's ken, the supposed head of it was detailed as an examiner, and almost constantly absent, for *two weeks.* Small wonder that some persons questioned the usefulness of his department!

The rational remedy for this state of things seems to be having at each yard one or two officers detailed especially for board duty.

RELATIONS OF THE INSPECTOR.

Closely allied with the subject of the inspector's duties is that of his relations with other persons in the yard.

1. *Relation to the Commandant.*—This has been sufficiently indicted. As an outdoor aid and technical adviser, he gives the commandant first-hand information of defects in work, shop methods, and yard conditions—suggesting remedies when he can. He is presumably impartial and "responsible to the commandant only."

2. *Relation to Manufacturing Heads.*—It is impossible for the administrative head of a manufacturing division to spend much time in the shops and yard. His subordinates are not always frank or disinterested. He can therefore, like the commandant, get much useful information from the officer whose business is *observing.* Reports of defects should often be made to him, rather than to the commandant, unless (a) suggestions are ignored; (b) the defect is typical and likely to be repeated until a general remedy is applied. In fact, the principle in question extends further—so long as faults are remedied, assistants should deal directly with foremen and leading men without consuming the time of the inspector and the divisional heads. This method causes less friction, is quicker, and is often more effective.

3. *Relation to Accounting Officer.*—The inspector and the "cost accountant" should co-operate strongly. One furnishes technical data; the other, costs. If figures are suspicious, the

accounting officer furnishes the clue for the inspector to follow. The summaries of estimated and actual costs offer much material for investigation. During the progress of certain work, an assistant investigating its cost gets daily charges against it from the accounting office. To illustrate the above:

(a) The cost of a certain box seems high. Examination of time cards shows that *first-class* labor was charged for *three* days, whereas a *third-class* man should have done the work in *two* days.

(b) Comparison of two summaries of costs shows that a valve for the *West Virginia* cost $50, while two similar valves for the *Colorado* cost $66. Evidently these charges require looking into.

(c) A charge in the foundry appears against the job order for the manufacture of a hammock. The accounting officer's attention is called to this. He investigates, finds a clerical error, and corrects the invoice price.

(d) The accounting officer notes that an expense account is growing from month to month. The inspector investigates and finds improper charges.

4. *Relation to General Storekeeper.*—The points of mutual interest to the inspector and general storekeeper may be summed up as follows:

The inspector is required to examine stores as to their condition.

He should also advise the general storekeeper as to the need (or lack of need) of certain articles of stock.

He should call attention to cases where work is held back through delays in delivery of material.

He should make report of articles not on charge, or not pertaining to special work, that should be turned into store.

He may advise as to the handling of scrap metal.

His duties with regard to surveys have been explained. He should inspect sale lots, and (when advisable), recommend withdrawals. If too many articles are held for the repair of others, or for repair when needed, he should recommend resurvey.

This list might be extended; but the close relation between the inspection and storekeeping departments is sufficiently clear.

5. *Relation to Ships.*—Ships' officers are required to inspect their own work. At one important navy yard they act quite independently of the yard department. This relieves the inspector and economizes time. It is found, however, that the yard in-

spectors can be of considerable value in watching shop work for ships, and in checking ship inspections on board. As stated above they can usually expedite work to advantage.

This feature of inspection duty has not been fully developed. If the inspector lacks assistants he is glad to let the ships alone; moreover, some ships' officers know very little about the inspection department.

6. *Relation to Workman.*—On the whole, the relation between inspection departments and foremen, leadingmen, and workmen seems to have been friendly—perhaps more friendly than a thoroughly efficient inspection force could expect. If defects are shown the workman and leadingman direct, and not made the subject of complaint, there should be no ill feeling. Certain narrow-minded workmen regard all members of the inspection force as "spies"; but this feeling is by no means general. A more general disposition is to regard them as idle spectators. In some cases inspection duty *is* performed in too leisurely a way, for it takes time to establish an *esprit* in a new department.

Some good suggestions as to methods of work or defects can be obtained direct from intelligent and well-disposed workmen. On the other hand, the inspector can do the men a friendly turn by reporting cases of bad lighting or ventilation, excessive heat or cold, unsanitary conditions, etc., observed in the shops.

CAUSES OF FUTILITY.

In what precedes the writer has tried to show what tends to make the inspector effective. The other side must be looked at. Why are his efforts sometimes futile?

Resentment of Criticism leading to Opposition.—Few people fail to resent criticism. Workmen, foremen, assistants, heads of departments, inspectors, often do resent it. The result may be a conscious or sub-conscious state of opposition to ideas of the critic. Those who, in an ideal world, would welcome his good suggestions sometimes, in human exasperation, damn whatever he proposes. Moreover, department heads may not like having the efficiency of their subordinates questioned. Foremen and others, feeling that the criticism is a hostile act, may not pass on it dispassionately. Opposition results in beclouding the issue and postponing the remedy.

Reference to Interested Foremen.—A good suggestion often falls dead because the man criticised is made the judge. A report is put in to the commandant, who refers it for comment to the head of division concerned. The latter, too busy or too little interested in outside reports to investigate personally, refers the matter for an answer to the very foreman whose methods are criticised. His report is signed by the head of department and forwarded to the commandant, who, considering the complaint answered, lets the matter drop.

An amusing instance of this came under the writer's observation. It was reported to an inspection officer that a superfluous man was being used on a planing machine. Before making the report the assistant had quite properly pointed this out to the leadingman, who, seeing that the suggestion was good, made the change and continued the work without difficulty. Meanwhile the inspector addressed an official memorandum to the head of department, who, after consulting the foreman interested, reported several days after the change had been made that it was "impracticable."

Pocket Vetoes.—If the inspector's efforts are not welcome, an easy way to nullify them is through the deadly pigeon-hole. This does not apply to specific rejections of work, which cannot be ignored, but to all general comments or suggestions. Even the broad-minded officer who is anxious to co-operate with all who can help him will "let sleeping dogs lie" because the pressure of routine is strong. What *must* be done crowds out what *may* be done. The result is that many good suggestions are buried alive. The writer recalls a case where an able and active staff officer, when cleaning house on detachment, found papers on his desk that had been there a year.

Fatal Delays.—Often after papers have run their course, the action taken is too late. It is discovered that a certain job order should be cancelled and purchase substituted for manufacture. The commandant or divisional head refers the report to an officer, who in turn refers it to a foreman. The change is finally recommended and the suggestion *approved.* Meanwhile the article has been duly manufactured and the ship has sailed! This may seem due to dilatory methods on the inspector's part. Not always so. The leadingman, even when advised direct, may await the word from someone up the line who hasn't reached a paper in his basket.

Perfunctory Action.—The greatest danger of futility lies in the fact that when reports *are* acted on promptly, their real meaning and usefulness is overlooked. Higher authority may fail to analyze them, study the questions raised, or issue orders that are the logical sequence of approval. The specific case may be settled and the principle left untouched.

It is reported that a foreman has been making fictitious charges against a job. One method of handling this report is to investigate and approve it—or to correct the charges. Another method is to investigate the foreman.

REMEDIES.

The above is written in anything but a pessimistic spirit. If the inspection department makes good, most of these troubles will cure themselves. In that case a feeling of permanency will greatly strengthen its hand. When General Order No. 53 has sunk in, and officers have grown familiar with it in practice, they will grasp the purpose and possibilities of the new department and will know how to use it. Its true usefulness will begin when it has won the confidence of commandants, department heads, and workmen. "By their fruits ye shall know them."

The elimination of unnecessary papers, and the centralization of offices and files should gradually remove the special difficulties referred to in connection with the handling of reports.

This result will be forwarded by an improved organization that will leave the higher yard officers freer from routine and better able to take up the class of questions raised by the inspector.

Gradual improvement in the organization of the inspection department, and the building up of an inspection *esprit*, will make the department what it should be. It takes years to develop methods of doing a new class of work; and years to build up the spirit that will make assistants ready to plunge in, work, and *speak out* for the good of the service.

RESULTS OBTAINED.

One's optimism is confirmed by looking over the record of the new department. At the larger yards, notwithstanding the good quality of work in general, hundreds of jobs pronounced complete have been rejected *for cause;* hundreds of cost reports

have been made with definite comment as to responsibility; numerous general recommendations have been made and approved.

From one yard, for instance, the following data was furnished for the fiscal year, 1910-11:

Number of job orders passed on	5550
Number reported unsatisfactory	250
Number of reports of excessive cost	186

The following are typical examples of general recommendations made by inspectors and approved. In some cases the matter had been bruited before; but for want of following up or of definite recommendations nothing had been accomplished:

Removal and sale of obsolete and useless machine tools.

Establishment of a proper stowage and cataloguing of dies.

Establishment of a custody storehouse for material removed from ships but invoiced to yard.

Systematic procedure as to packing and crating, involving use of old packing material.

Classification of costs of manufacture of standard patterns.

Preventing accumulation of material not on charge.

Preparation of supplementary job orders and estimates in case of work on jobs not originally contemplated.

Purchase instead of manufacture in various cases.

Postponement until needed of repairs on surveyed articles of doubtful value.

Steps to prevent deterioration of rubber in store.

Steps to prevent deterioration of machinery in store.

Systematizing work on manholes on shipboard.

Better co-ordination between draughting rooms and shops.

Steps to remedy excessive heat in sail loft.

This list might be greatly extended; but the above suggests the variety and importance of feasible suggestions emanating from inspection departments. No mention is made of extensive investigations and recommendations that have not yet borne fruit.

The great improvement in methods of inspection by ships' officers should also be noted. Work is followed up carefully, and records are systematically kept.

Finally, the best evidence of good silently accomplished is the absence of vociferous complaints as to bad work, delays, and wasteful methods, so common a few years ago.

FUTURE OF THE INSPECTION DEPARTMENT.

Granting the necessity of inspections in some form, and admitting the advantages of a separate department; accepting the ideals of such a department and realizing its difficulties—the final question is: Shall we keep or discard the inspection department?

It seems logical that it should continue as an essential part of the modern navy yard organization. We must remember that the quality of the output is not checked, as in a civilian plant, by competition and the demands of the consumer. There are no other "resident inspectors." The government, forced to patronize, *must inspect for itself.* Adopting as desirable the idea of an inspector for each shop, we must decide: Shall he report to his foreman or to a chief inspector responsible only to the commandant? The answer seems plain.

In this case, the chief inspector should have a small staff who, freed from even an inspection routine, may give undivided attention to general investigations. What has been done already shows what might be done. By a system of interchange, results obtained at one yard could be extended to others.

With the shop inspectors watching details and the chief inspector keen for large improvements, the people, demanding good workmanship in exchange for their millions, might have a confidence that figures fail to give.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WILLIAM BARKER CUSHING.

By CHARLES W. STEWART.

> On four previous occasions the Department has had the gratification of expressing its approbation of your conduct in the face of the enemy, and in each instance there was manifested by you the same daring and innate love of perilous adventure—a mind determined to succeed and not to be deterred by any apprehensions of defeat. (Extract from letter of Secretary of the Navy to Lieutenant Cushing, November 9, 1864, relative to the sinking of the Confederate ram *Albemarle*.)

The biography that tells when a man is born, married, died and a few other important events in his life is easily prepared and is of little value. The real history of the man should reveal the motives and aims that impel him in his life struggle, his joys and sorrows, triumphs and disappointments, hopes and fears. It should present the summing up of the fruits of his life. A great soul fully unveiled would be a treasure for all time; but this we can never have. We can only form an imperfect judgment of men by their acts, speech, and correspondence, as we may know them and reason from them. What better can a man do than to leave to the world a good example, and what better can a writer do than to publish and preserve the story of the brave and the true! The acts, habits, character, of the man Cushing are unusual; he lifted the sword from pure notions. His conscience was in his work. He was never wounded yet his deeds of heroism are many. Generous, good and gallant, he commands the respect of all men, and his story will live as an enduring monument.

William Barker Cushing, born 1842, died 1874, served in the United States Navy from 1857 until his death, excepting only a few weeks in the year 1861. He achieved in the Civil War, and before he had completed the twenty-second year of his life a name and a fame apart from that of all other officers in our navy. From 1861 to 1865 he was conspicuous for his courage and gallantry in many daring and hazardous exploits, most of which he personally

planned and executed, ranging from the burning of blockade runners under the enemy's guns to his supreme success, the blowing up of the Confederate ironclad ram *Albemarle*.

It is difficult to describe in trite terms the unflinching fortitude, the undaunted valor, the brave heart of this boy, who was a hero in every sense and meaning of the word. An account of his life is an essay on courage, a story of valor and victory.

Cushing's ancestors were of sterling New England stock, Anglo-Saxons, sprung from the valiant races of Northmen, the greatest sea-fighters of the world.

Zattu Cushing, a ship carpenter, born at Plymouth Rock, attained his majority in 1791 and left his father's home and ship repair yard at Plymouth, Massachusetts. At Ballston Spa, New York, he married Miss Rachel Buckingham in 1795. He built the good ship *Good Intent* at Erie in 1799. In 1805 he settled as a pioneer at what is now Fredonia, New York, with his wife and several children, among them Milton Buckingham Cushing, destined to become the father of our hero. Here Zattu lived, a devout churchman, successful business man and a presiding judge, until his death in 1839. A volunteer soldier at the battle of Buffalo, but always a leader resourceful, energetic, and of indomitable will, he was a fine example of American manhood.

The son Milton studied medicine and practiced at Zanesville, Ohio, where he became a husband and a widower. Later, while engaged in business at Columbus, Ohio, he met and married, in 1836, Miss Mary Barker Smith,[1] of Boston, aged 28.

What a thing it is to be well-born and to feel the impulses imparted by generations of honorable ancestors such as these, who gave to William Cushing his heritage of valor and virtue.[2]

[1] It is recorded that (1) Thomas Smith of Brinsspittae, England, bore a son (2) Rev. John Smith, who settled at Barnstable, Mass., in 1630 and married Susannah Hinckley: Their son (3) Joseph Smith, in 1689, married Ann Fuller, who bore thirteen children, the ninth being (4) Rev. Thomas Smith, who married Judith Miller in 1734: Their son (5) Josiah Smith married Mary Barker in 1760 and bore (6) Elisha Smith, who married Mary Butler Bass, 1806: Their first born (7) Mary Barker Smith, married Dr. M. B. Cushing at Columbus, Ohio, in 1836, and became the mother of Milton, Howard, Alonzo, William and Isabel Cushing, as set forth.

[2] When Commodore Joseph Smith, nephew of (6) Elisha Smith, heard in Washington the telegram announcing that the U. S. S. *Congress*, commanded by his son, Lieutenant Joseph Smith, had surrendered at Hampton Roads, he quietly said "Then Joe is dead." How certain the father was of his son, both of the same blood as Cushing.

After the birth of their first son, Milton, the Cushing family moved West. Howard B., the second son, was born at Milwaukee in 1838. Near the present town of Delafield, Wisconsin, were born Alonzo H. Cushing in 1841; William Barker Cushing, November 4, 1842, and a daughter, Isabel, now Mrs. E. H. Bouton of Chicago. In 1844 Doctor Cushing moved to Chicago, and in 1847 to Gallipolis, Ohio, where he died in the same year. Mrs. Mary Barker Cushing, with her children, then moved to Fredonia, New York, where she established a successful school for children. Her boys aided in the support of the family.

In 1856 Hon. Francis S. Edwards, brother-in-law of Mrs. Cushing and a member of Congress, secured for William an appointment as page in the House of Representatives where he was a favorite with the members.

In 1857, through the aid of his kinsman, Commodore Joseph Smith, U. S. Navy, William was appointed a midshipman at the U. S. Naval Academy. Alonzo became a cadet at West Point in the same year.[1]

At the Naval Academy, Cushing was not noted for studiousness, but he stood fairly well in his first years, and in the first ten of his class in the latter years at the academy. He was fond of practical jokes and never felt that awe of his "superior officer" which oppresses most naval and military men from the cradle to the grave. He received 99, 188, 155, and 147 demerits during his first, second, third and fourth years respectively at the academy. The only serious report found against him was for overstaying his leave in January, 1861. This could not have been considered *very* serious, for but ten demerits were given him for that month and the offense was not mentioned in the report which caused his resignation in March, 1861. In his second class year, with 37 members, he stood 3 in gunnery, 8 in ethics, 13 in astronomy, and 9 in general order of merit, and last in conduct. For his first class year, with 27 members (at semi-annual examination in February, 1861), he stood 6 in ethics, 7 in gunnery, 9 in artillery, 11 in philosophy, 25 in modern languages and 6 in general order of merit, a high standing for a youth who has been considered as "not savvy."

[1] Lieutenant-Colonel Alonzo H. Cushing, U. S. Army, fell at Gettysburg, July 3, 1863, at the very apex of Pickett's Charge, in his twenty-second year. Howard B. Cushing, U. S. Army, was killed by Apaches in the Whetstone Mountains, Arizona, May 5, 1871. Paymaster Milton B. Cushing, U. S. Navy, retired, died January 1, 1886.

Cushing from boyhood was daring and dashing. He rode and drove horses at break-neck speed, climbed trees higher, swam farther and dived deeper than the other boys. He shot straight, hit hard, and feared no man. The story is told that, when a midshipman on leave, visiting his aunt, Mrs. Joshua Loring, at Chelsea, Mass., a youth named ———— on the sidewalk in front of the Universalist Church, commented sneeringly on his short uniform jacket, and Cushing went for him. The battle raged over the sidewalks and the dusty streets. Both fighters were covered with blood and dust, but the midshipman was the victor and afterwards walked the streets of Chelsea quite free from comments on his beloved uniform.

Cushing made clever pencil sketches and this accomplishment led to his most serious difficulty at the academy. The head of the department of modern languages was Professor E. A. Roget, a man of distinguished and dignified bearing, generally called "The Don." While the professor was crossing a street of Annapolis in January, 1861, he walked in front of a vicious cart horse that severely bit his shoulder. Sometime afterward on entering the section room he found his class laughing over a sketch on a fly-leaf of Cushing's book. He demanded the book and found a clever drawing of himself biting the neck of a horse, and the inscription "The poor old Don, he bit the hoss." The professor excitedly shouted out "I deed not bite the hoss. The hoss he bite me," and, when the class roared with laughter, the angry professor rushed over to the superintendent's house and demanded Cushing's immediate dismissal, which was, of course, refused. However, at the February examinations, in 1861, Cushing was found deficient in Spanish and the following report was forwarded by Superintendent Blake to the Department.

> Deficient at February semi-annual examination, 1861. Midshipman William B. Cushing. Deficient in Spanish. Aptitude for study: good. Habits of study: irregular. General conduct: bad. Aptitude for Naval Service: not good. Not recommended for continuance at the Academy.
>
> Endorsement.
>
> The same recommendation [refers to a preceding favorable recommendation that another midshipman of the first class be retained at the Academy and be turned back one year] cannot be made in the case of Midn. Cushing of the 1st class on account of the very unfavorable opinion expressed in this re-

> port of his habits of study, conduct, and fitness for the naval service. He has been sick for a considerable time but this affords no palliation for neglect of study previous to his sickness nor for continued delinquencies in conduct throughout the term.

There is told the story that, in January, 1861, Cushing obtained leave for a week in order to be with a favorite aunt who was ill and lonely at a hotel in Washington, and he did not return to the Academy at the expiration thereof but asked for an extension. Captain Blake, the superintendent, meeting Commodore Smith and asking after Mrs. Smith's health, thinking she was the aunt whom Cushing was visiting, was surprised to learn that she was not ill, and on Cushing's return to Annapolis accused him of making a false statement regarding his aunt's health and need of his presence. Cushing, it is said, replied hotly and incurred Blake's enmity by his counter charge that the superintendent himself belonged in the Ananias class. It certainly was an unusual proceeding to dismiss a first classman, standing high in his class, for being unsatisfactory in Spanish, and one is forced to conclude that some personal resentment entered largely into the motives for prompting summary action in his case. It is said by his schoolmates that Cushing was careless in dress and spent a large part of study hours in visiting his friends, and playing pranks, thus acquiring many demerits. It is remarkable that a youngster of 18 years should be able to stand high in his studies with little effort, and it shows that he possessed a good memory, arranged facts logically, and had good nerves. He knew the habits of the watchmen, evaded them readily and could outsprint all of them. He would carefully hide a bottle for the zealous watchmen searching for whiskey to find, but the bottle would contain tea. One of his pranks was called "the tea-party." It was the custom to prepare large tin buckets of tea and to set them on a shelf outside the kitchen windows to cool. Cushing prepared a large hook which he lowered by a rope from an upper window, caught the pails with the hook, drew up the tea and after drinking a part and pouring out the rest, refilled the buckets with water and replaced them on the shelf below, much to the dismay of poor Dorsey the steward, who served that evening the weakest tea that ever graced the middies' supper table.

Half a century ago this skylarking boy played his tricks, danced and fought and laughed and sang, and bested most of his class-

mates, though the youngest of them all, an infant in the eye of the law. Seen through the haze and mists of 50 years it appears that Cushing did well, perhaps quite as well as the officers who condemned him.

Captain Blake's endorsement resulted in Cushing's resignation on March 23, 1861. Several of his classmates, who had resigned to go South, were in Washington and they suggested that he go with them, but to his credit he refused to do so. He spent some days with his friend, Lieutenant Charles W. Flusser, at Annapolis, and went with Flusser on one of his cutting-out expeditions. With a sinking heart he saw the Constitution and Baltic, carrying the midshipmen and Naval Academy outfit, sail for Newport, R. I., where the Naval Academy was located from 1861 to 1865. Flusser was a favorite with General B. F. Butler, commanding U. S. Army forces at Annapolis. Butler who had been at Bowdoin College the chum and room-mate of Gustavus Vasa Fox, the able Assistant Secretary of the Navy, asked Mr. Fox to consider Cushing's case, and with this aid and that of Commodore Smith, Cushing was accordingly appointed an acting master's mate and served from May to September, 1861, on the U. S. S. *Minnesota*, Flag-Officer Stringham's flagship in the Atlantic blockading squadron. As prize-master he took the *Delaware Farmer* to Philadelphia; and later with one volunteer officer and only the captured crew of the *Pioneer* safely sailed that prize to New York in May, 1861, standing watch and watch, with his one officer. This dangerous prize duty at an early age has frequently been cited as showing high courage and ability in other officers of our navy.

Cushing received from Flusser much good advice and also a charming little volume entitled "Naval Enterprise, Illustrative of Heroism, Courage and Duty." This little book, given by Fox to Flusser, and later by Flusser to Cushing, related inspiring stories of naval heroes, cutting-out expeditions, desperate struggles, forlorn hopes, audacious and successful attacks by sailors, seamen, midshipmen and officers, mainly of the British Navy, and it inspired Cushing to courageous deeds. Some of its phrases are found in the reports of Flusser and Cushing. A companion book entitled "Military Enterprise" gave stimulating stories of the achievements of soldiers from Leonidas at Thermopylæ, to Cardigan and Nolan of the Light Brigade in the Crimean War.

Cushing set out to gain the favor of the Department and his place in the naval service, encouraged by friends who understood

something of the spirit of this eighteen-year old boy. At Hatteras Inlet, on the *Minnesota,* flagship of Flag-officer Stringham, he did well, but in fun referred to his commander-in-chief as " Old Sting 'em " and gained the ill-will of the flag officer, who forwarded his resignation as acting master's mate with a cruel endorsement, although he knew that Cushing's intention and hope was to obtain reinstatement as midshipman in his class. Stringham later grudgingly admitted that Cushing's service as acting master's mate had been in some respects meritorious, and Captain Blake also later reported that he was of the opinion that Cushing could become a good officer and recommended his restoration as a midshipman in his class.

A story is told that during Cushing's service on the *Minnesota* he discovered a certain officer of the deck asleep on watch. This lieutenant had been particularly offensive to Cushing and had lorded it over his junior officers. On discovering the officer asleep on watch at night, Cushing called witnesses, and swung a lighted lantern in the face of the sleeping man to prove positively that he was asleep, but he later abandoned the first impulse of revenge, and upon considering the serious results of a Court Martial, and did not report his superior officer because he thought it would be taking a mean advantage.

Cushing's letters to his mother, written from the Naval Academy, express his love of the sea and of his profession, and of his mother, and of his desire to graduate and contribute to her comfort and support.

Extracts of two letters to his mother are given to show the resolute prize-master, aged 18 years, and man of religious faith, aged 19 years.

EXTRACT FROM LETTER DESCRIBING DUTY AS PRIZE-MASTER.

U. S. PRIZESHIP " PIONEER," May 24, 1861.

MY DEAR MOTHER: It is night and your youngest son is writing you in the cabin of the ship, *Pioneer,* now on her way to New York in my charge. This vessel belongs to Richmond, Va., and was captured three days ago for violating the blockade established by the President.

The *Minnesota* reached Hampton Roads nearly two weeks ago and the day after her arrival she captured a vessel loaded with tobacco and valued at about seventy-five thousand dollars. I was at once made prize-master of her and I carried her into Philadelphia. I then returned to the *Minnesota* and the following morning, was again a prize-master. So here I am on the broad Atlantic bound for New York. The flag officer could spare no men; so this ship's own crew of sixteen were left on board.

I have one man, master's mate of the *Cumberland*, named Harrington, to assist me and we have to keep unceasing watch and watch sharply.

As I write, I feel the weight of a brace of revolvers on my belt, and I know not at what moment the crew may try to retake her; but your boy is ready, and I trust no son of yours is a coward.

Now I must go and have the pumps sounded in order to see that none of the crew have scuttled her. Give my love to all dear friends.

Your affectionate son,

W. B. CUSHING.

EXTRACT FROM LETTER DESCRIBING A STORM AND HIS FAITH.

U. S. S. "CAMBRIDGE," Feb. 24, 1862.

MY DEAR MOTHER: It is blowing as if all the "Nor'westers" in the world had been tied up for the last twenty years, and had just broken loose. The waves have been rolling twenty feet high all the afternoon, dashing against us, and making the old ship shiver like a freezing giant.

The lower and top sail yards have been sent down and the top-masts "housed." The wind howls through the rigging and the waves beat madly against us, waves that would almost dash right over our house at home. Madly they strive to rend this stout oaken frame, timber from timber.

Yet, how calm I feel, just the same as in the most beautiful calm that ever fell upon the bosom of old ocean.

A huge, roaring foam-crested mass of water comes dashing over the bows and sweeps the deck, fore and aft. Yet here am I with only six inches of plank between myself and the wild, deadly, sublime wrath of Nature's moving throne.

If there is one time more than another when one realizes God's greatness and His mercy, it is at such a moment as this. A man who has a heart, must think of the time when Christ said to such a sea "Peace! Be still."

He is *now* with those who are their country's defenders as He was with the apostles of old. His shield guards us and His arm is between us and death.

I am not, as yet, what the world calls a Christian, but I do believe implicitly in God's power and goodness, and that not even a sparrow can fall to the ground without His knowledge.

Often, I feel as held in the hand of God.

"They that go down to the sea in ships, that do business in great waters; these see the works of the Lord and his wonders in the deep."

As usual it is very late and I must turn in.

Give love to all dear ones.

Your affectionate son,

WM. B. CUSHING.

Restored to the navy in October, 1861, as an acting midshipman, Cushing was assigned to the North Atlantic Squadron, and on the U. S. S. *Cambridge* became ill from over-work and exposure; was

granted sick leave in March, 1862, ordered again to the *Minnesota in* May and gained some reputation for daring and courage as opportunities offered.

The increase of the commissioned personnel by Act of July 16, 1862, made Cushing a lieutenant at the age of 19. Cushing wrote from the *Hunchback,* August 20, 1862, to his mother as follows:

MY DEAR MOTHER: For the last two weeks I have been in the City of Newbern waiting for Commander Davenport to return so I could report for duty.

I asked permission to go down to Plymouth as first lieutenant of the gunboat *Commodore Perry.* I want to go there because Lieut-Commander Flusser is the fighting man of the Sounds and we are going to attack a

U. S. S. "COMMODORE PERRY."

seven-gun battery up Roanoke River. Flusser is daring to the death and chuck full of fight. The engine shakes the vessel so it would be hard to write if there were no other cause, but when you add a nor'-westerly gale and a heavy head sea, you can imagine it is next to impossible to write. However, if you can read it, it is all that is required.

I am promoted. Not one grade but three. Perhaps it will interest you, mother, to know I am the only man who has ever reached this rank at anywhere near my age. I am not yet twenty. Aren't you glad for me, mother, dear?

Flusser asked for him and he was made executive officer of the *Commodore Perry.* Under Flusser's eye he performed a deed of gallantry that deserved immediate and substantial recognition. As the little squadron of three wooden steamers was descending

the Blackwater River after the battle of Franklin, October 3, 1862, the *Commodore Perry* jammed her bow into the bank at Crumpler's Bluff and was charged by a strong force of Confederates. Flusser ordered all hands to cover, but Cushing called for volunteers, ran a field-piece out on the forecastle of the *Perry* and, although every man with him was killed or wounded, he bided his time, took careful aim and at the proper moment pulled the lanyard and discharged his howitzer in the faces of the advancing enemy, who were thrown into confusion by the unexpected roar and storm of missiles, and were driven off with heavy loss by Flusser's men who reappeared from under cover. The *Commodore Perry* and probably her consorts were thus saved from capture.

In his official report Flusser warmly commended Cushing as follows:

I desire to mention as worthy of praise for great gallantry, Lieutenant William B. Cushing, who ran the fieldpiece out amid a storm of bullets, took a sure and deliberate aim at the rebels, and sent a charge of canister among them that completely silenced their fire at that point. Mr. Lynch assisted Mr. Cushing, and here met his death like a brave fellow, as he was. Mr. Richards, third assistant engineer, who had charge of the powder division, also assisted with the howitzer, and showed great courage.

Mr. Anderson, the paymaster, was of great assistance in bringing in the wounded from under the fire, and conveying them to the doctor.

Rear-Admiral Lee immediately assigned him to the command of a little captured Confederate steamer, the *Ellis*, under a sort of roving commission. He burned the roving schooner *Adelaide* of Halifax, and later destroyed a large salt works in New Topsail Inlet.

Cushing's visit to the enemy's country and capture of Jacksonville, N. C., in November, 1862, and the loss of his vessel due to grounding under the enemy's guns are described in the following official correspondence. Although he lost his vessel he did it with such coolness and courage that he received the warm commendation of his superiors.

U. S. S. "HETZEL," Off New Berne, N. C., November, 27, 1862.

SIR: I have the honor to enclose herewith a report of Lieutenant William B. Cushing of his operations at New River Inlet, by which you will perceive that the U. S. S. *Ellis* is lost.

I trust that, in consideration of the courage, coolness, and gallantry displayed on the occasion by Lieutenant Cushing, his course may meet with the approval of yourself and the honorable Secretary of the Navy.

I have the honor to be, very respectfully, your obedient servant,

H. K. DAVENPORT,

Commander and Senior Officer in Sounds of North Carolina.

ACTING REAR-ADMIRAL S. P. LEE,

Commanding North Atlantic Blockading Squadron.

(Enclosure.)

U. S. S. "HETZEL," November 26, 1862.

SIR: I have the honor to report that I entered New River Inlet on the 23d of this month with U. S. S. *Ellis* under my command; succeeded in passing the narrow and shallow place called "The Rocks," and started up the river. My object was to sweep the river, capture any vessels there, capture the town of Jacksonville, or Onslow Courthouse, take the Wilmington mail, and destroy any salt works that I might find on the banks. I expected to surprise the enemy in going up, and then to fight my way out.

Five miles from the mouth I came in sight of a vessel bound outward, with a load of cotton and turpentine. The enemy fired her to prevent her from falling into our hands. I ran alongside, made sure that they would not extinguish the flames, and again steamed up the river.

At 1 p. m. I reached the town of Jacksonville, landed, threw out my pickets, and placed guards over the public buildings. This place is the county seat of Onslow County, and is quite an important town. It is situated on the right bank of the river, going up, and is 35 or 40 miles from the mouth. I captured 25 stand of public arms in the court-house and post-office, quite a large mail, and two schooners. I also confiscated the negroes of the Confederate postmaster. I forgot to mention that the town is situated on the main dirt road to Wilmington. Several rebel officers escaped as I neared the place and carried the news to that city. At 2.30 p. m. I started down the river, and at 5 p. m. came in sight of a camp on the banks, which I thoroughly shelled. At the point where the schooner captured in the morning was still burning, the enemy opened fire on the *Ellis* with rifles, but were soon silenced by our guns. I had two pilots on board, both of whom informed me that it would be impossible to take the steamer from the river that night. High water and daylight were two things absolutely essential in order to take her out. I therefore came to anchor about five miles from the outer bar, took my prize alongside, and made every preparation to repel an attack. All night long the signal fires of the enemy could be seen on the banks. At daylight I got underway, and had nearly reached the worst place in the channel when the enemy opened on us with two pieces of artillery. I placed my vessel in position; at once hoisted the battle flag at the fore; the crew gave it three cheers and we went into action. In one hour I had driven the enemy from his guns and from the bluff and passed within a hundred yards of their position without receiving fire. Up to this time I had been in every way successful, but was here destined to meet with an accident that changed the fortune of the day and resulted in the destruction of my vessel. About 500 yards from the bluffs the pilots, mistaking the channel, ran the *Ellis* hard and fast aground. All hands went to work at once to lighten her, and anchors and steam used to get her afloat, but without success. The headway of the steamer had forced her over a shoal and into a position where, as the center of a circle,

we had a circumference of shoal all around. When the tide fell I sent a party ashore to take possession of the artillery abandoned in the morning; but when they reached the field it was discovered that it had been removed while we were at work on the vessel. If I had secured this, I proposed to construct a shore battery to assist in the defense of my vessel by keeping the rebels from placing their batteries in position. At dark I took one of my prize schooners alongside and proceeded to take everything out of the *Ellis* excepting the pivot gun, some ammunition, 2 tons of coal, and a few small arms. Steam and anchor again failed to get my vessel afloat. I felt confident that the Confederates would come on me in overwhelming force, and it now became my duty to save my men. So all hands were called to muster and the crew told that they could go aboard the schooner. I called for six volunteers to remain with me on board and fight the regaining gun. Knowing that it was almost certain death, the men came forward, and two master's mates, Valentine and Barton, were amongst the number. These gentlemen subsequently behaved with coolness and bravery. I ordered the schooner to drop down the channel out of range from the bluffs, and there to wait for the termination of the impending engagement, and if we were destroyed, to proceed to sea.

Early in the morning the enemy opened on us from four points with heavy rifled guns (one a Whitworth). It was a cross fire and very destructive. I replied as best I could, but in a short time the engine was disabled and she was much cut up in every part, and the only alternatives left were surrender or a pull of one and a half miles under their fire in my small boat. The first of these was not, of course, to be thought of; the second I resolved to attempt. I fired the *Ellis* in five places, and having seen that the battle flag was still flying, trained the gun on the enemy so that the vessel might fight herself after we had left her, and started down the river, reached the schooner, and made sail for sea. It was low water on the bar and a heavy surf was rolling in, but the wind forced us through after striking several times. We were just in time, for about 600 yards down the beach were several companies of cavalry, trying to reach the mouth of the inlet in time to cut us off. We hoisted our flag, and gave three cheers and were off. In four hours I reach Beaufort. I brought away all my men, my rifled howitzer and ammunition, the ship's stores and clothing, the men's bags and hammocks, and a portion of the small arms. I retained aboard a few muskets, pikes, and pistols to repel boarders.

I neglected to state that when I took possession of the enemy's ground on the 24th a salt works was destroyed and ten boats rendered useless that were to have been used for boarding. At 9 a. m. the U. S. S. *Ellis* was blown in pieces by the explosion of the magazine. Officers and men behaved nobly, obeying orders strictly under the most trying circumstances. I respectfully request that a court of enquiry may be ordered to investigate the facts of the case, and to see if the honor of the flag has suffered in my hands.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,
Lieutenant.

COMMANDER H. K. DAVENPORT,
Senior Officer, Commanding in Sounds of North Carolina.

(Endorsement.)

Respectfully submitted. I think the course of this young officer should meet with the commendation of his superiors.

H. K. DAVENPORT,
Commander and Senior Officer.

(Second Endorsement.)

Received and forwarded, December 2, 1862, with the expression of my admiration of Lieutenant Cushing's coolness, courage, and conduct.

S. P. LEE,
Act. Rear-Admiral, Comdg. North Atlantic Blockade Squadron.

Captain William Harwar Parker, of the United States and Confederate Navies, in "Recollections of a Naval Officer," wrote:

Young Cushing had been a pupil of mine at the Naval Academy in 1861. He was rather a delicate looking youth; fair, with regular, clear-cut features, and a clear grayish-blue eye. He was first brought to my notice during the war by my happening to get hold of his report of the loss of the U. S. Steamer *Ellis*, under his command at New River Inlet, Nov. 24, 1862. I was impressed with this part of his official report (the italics are mine): "and the only alternatives left were a surrender or a pull of one and a half miles under their fire in my small boat. The first of these was not, *of course*, to be thought of." Knowing him to be at that time but 19 years old, I comprehended his heroic qualities and was not at all surprised to hear more of him. Immediately after the war I went to San Francisco, and my first visitor was Cushing. He was the hero of the hour, and the citizens made much of him. Under the circumstances I thought he conducted himself with much modesty.

Admiral David D. Porter, U. S. Navy, wrote:

Flusser was a cool and daring officer. He was always to be found where fighting was going on.

There was another young officer in the North Atlantic Squadron at this time, Lieutenant William B. Cushing, who made a name for himself by his total disregard of danger.

He would undertake the most desperate adventures where it seemed impossible for him to escape death or capture, yet he almost always managed to get off with credit to himself and with loss to the enemy. He commanded the small gunboat *Ellis*, and in November, 1862, it struck him that he would enter New River Inlet, push up the river, sweep it clear of vessels, capture the town of Jacksonville or Onslow Courthouse, take the Wilmington mail and destroy any salt works he could find on the banks. He expected to surprise the enemy on going up, and then fight his way down. The account of the loss of the *Ellis* is given as an illustration of this young officer's character and his fancy for seeking adventures. There was nothing particularly to be gained by his trip up New Inlet River, and there was a chance of losing his vessel. He lost her, but in doing so, showed his spirit of adventure, risking his life and the lives of his men,

and then escaping with his crew, arms, provisions and clothing, setting fire to his vessel and training her guns upon the enemy so that she might give them a broadside as she went out of existence.

One of the schemes of Cushing for capturing Wilmington pilots by disguising his vessel, a schooner, as a blockade-runner, and enticing the pilots aboard was frustrated by the weather and vigilance of the enemy, yet he succeeded in capturing and destroying a Confederate camp.

U. S. S. "HETZEL," New Berne, N. C., November 26, 1862.

SIR: I respectfully request that I may receive orders to take the prize schooner *Home* for the purpose of capturing some Wilmington pilots. I propose to disguise her as an English vessel, painting her lead color, altering her rig, etc. By boldly entering New Inlet, chased by one of the blockading fleet, I can succeed. When I get under the guns of the forts I will wait for pilots or boats from the shore. All persons that come aboard I will make prisoners, and stand out from under the fire of the forts. If an armed tug should come alongside I will take her by boarding.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,
Lieutenant U. S. Navy.

COMMANDER H. K. DAVENPORT,
Senior Officer, Commanding in Sounds of North Carolina.

U. S. S. "HETZEL," Off New Berne, N. C., November 29, 1862.

SIR: In reply to your letter of the 26 instant, asking permission to take the prize schooner *Home* for the purpose of capturing some Wilmington pilots, I have to state that upon careful consideration of your proposition I deem it advisable that you should bring the subject to the notice of the acting rear-admiral and receive his instructions.

You will therefore proceed by first opportunity to Hampton Roads and on your arrival there report to Acting Rear-Admiral Lee on board the U. S. flag steamer *Philadelphia*.

I am, etc.,
H. K. DAVENPORT,
Commander, etc.

LIEUT. WILLIAM B. CUSHING, U. S. Navy.

U. S. S. "HETZEL, New Berne, N. C., December 26, 1862.

SIR: I beg leave to state that in conversation with Acting Rear-Admiral Lee, and also with the Assistant Secretary of the Navy, both approved of the enterprise which I have in contemplation; and I leave for Beaufort tomorrow and will do my best to carry out my plans.

WM. B. CUSHING,
Lieutenant, U. S. Navy.

COMMANDER H. K. DAVENPORT,
Commander and Senior Naval Officer in Sounds of North Carolina.

EXTRACT FROM A LETTER FROM THE ASSISTANT SECRETARY OF THE NAVY TO REAR-ADMIRAL LEE, U. S. NAVY.

NAVY DEPARTMENT, December 9, 1862.

I told him (young Cushing) he might go at any scheme you consented to. Rashness in a young officer is rather commendable. Blunt has sent you four pilots. The pilots in Fort Lafayette are not to be trusted. The *Sunbeam* had an English pilot and Seward lets them all go.

ACTING REAR-ADMIRAL S. P. LEE,

Comdg. North Atlantic Blockading Squadron, Old Point Comfort.

U. S. S. "HETZEL," December 26, 1862

SIR: In reply to your letter of this date, I will say that in consequence of the approval of Acting Rear-Admiral Lee and the Assistant Secretary of the Navy of your plans you are ordered to proceed to carry them out at once.

I am, sir, very respectfully, your obedient servant,

H. K. DAVENPORT,
Commander, etc.

LIEUTENANT W. B. CUSHING, U. S. NAVY.

U. S. FLAGSHIP "MINNESOTA," NEWPORT NEWS, Va., January 9, 1863.

SIR: I have the satisfaction of enclosing a copy of a report (January 8) from Lieutenant W. B. Cushing, regarding the results of an enterprise, conceived and carried out by him under my sanction, to capture Wilmington pilots, and which, though unsuccessful in its immediate object both as Cape Fear River and at Little River, where he landed and carried by storm an earthwork, does great credit to the gallantry of this promising young officer.

I have the honor to be, sir, very respectfully, yours,

S. P. LEE,
Actg. Rear-Admiral, Comdg. North Atlantic Blockading Squadron.

HON. GIDEON WELLES,
Secretary of the Navy, Washington, D. C.

I have already ordered Lieutenant C. here to command the *Commodore Barney*.

CUSHING'S REPORT.

BEAUFORT, N. C., January 8, 1863.

SIR: I have the honor to report that I failed to capture the Wilmington pilots because my schooner was three times becalmed, inshore, at the points where I desired to act. Having learned, however, that there was a pilot station at Little River, 30 miles below Fort Caswell, I made sail for that point and reached it on the morning of the 5th. At 8 o'clock at night I crossed the bar with three cutters and twenty-five men, and proceeded up the river. My object was to look for pilots, and also to find some schooners

supposed to be inside. About a mile from the mouth the enemy gave us a volley of musketry from a bluff on the left.

I beached the boats at once, formed my men about 200 yards from the enemy's position, and gave the order, "forward; double quick; charge." Without firing a musket the men moved forward, and when we got clear of the woods I saw a fort in front and the light of the camp fires. Knowing that the rebels were ignorant of our numbers, I charged with the bayonet and captured their works, going over one side as they escaped over the other. I found the fort an earthwork, surrounded by a ditch about 10 feet broad and 5 feet deep. Inside was a blockhouse pierced for musketry. No guns were mounted. I learned that it was held by one company of infantry. The enemy left in such haste that their stores, clothing, ammunition, and a portion of their arms were captured. I destroyed all that I could not bring away. I went a short distance farther up the river; had another skirmish; did not see the schooners; got out of ammunition and returned with the loss of but one man shot in the leg. In conclusion, I beg leave to state that officers and men behaved nobly. Acting Master's Mates Valentine and Hicks were with me. Acting Master Savage, commanding mortar schooner *Matthew Vassar,* furnished me with two boats and a portion of men.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,
Lieutenant, U. S. Navy.

COMMANDER A. MURRAY,
Senior Officer, Commanding, Sounds of North Carolina.

P. S.—The fort was in South Carolina, 1 mile from the border line.

It has been asserted that Cushing was foolhardy and tremendously lucky, but the records clearly show that he planned carefully and executed vigorously. Further, his projects had the approval of the Navy Department, yet when failure seemed probable, he never lost his presence of mind and did the best thing in the best manner possible.

Admiral Porter wrote of this event:

On January 5 the indefatigable Lieutenant Cushing started on an expedition to capture some Wilmington pilots, and having heard that there was a pilot station at Little River, thirty miles below Fort Caswell, he made sail for that point, and reached it on the morning of January 5, 1863. He crossed the bar at 8 o'clock at night with twenty-five men, in three cutters, and proceeded up the river. He was in the hopes of finding pilots above and also some schooners. About a mile from the mouth of the river the expedition received a volley of musketry from a bluff on the left. Cushing beached his boats the moment he was fired upon, without returning the fire, and formed his men about 200 yards from the point of attack, and gave the order: "Forward—double quick—charge!" The fearless fellow never stopped to consider whether he was charging fifty men or a thousand. It seemed immaterial to him, when his blood was up, how many of the enemy faced him; and his men inspired by his intrepid example, followed him without hesitation.

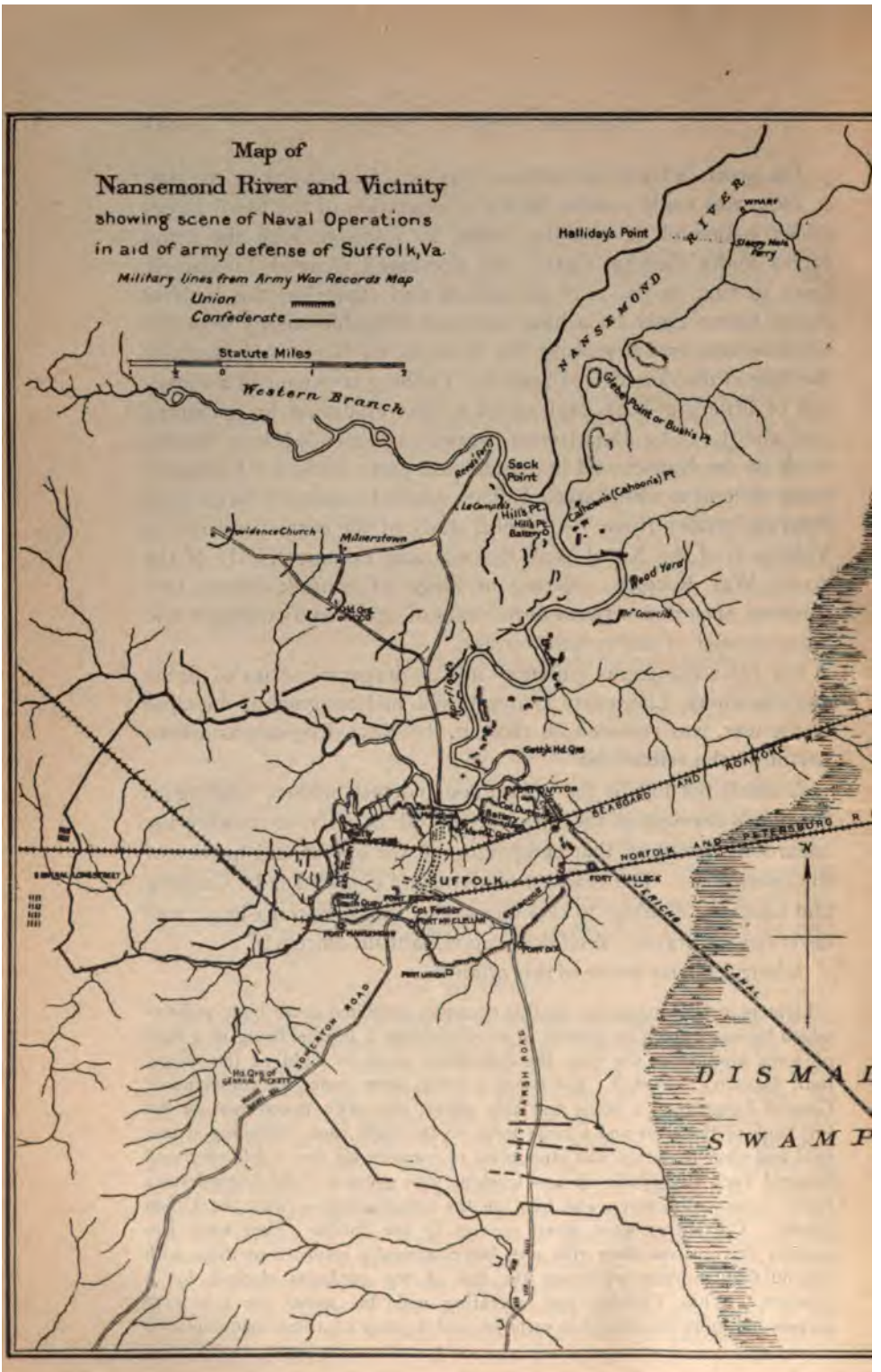
The army defense of Suffolk, Virginia, from April 11 to May 4, 1863, was made possible by the co-operation of the naval forces under command of Cushing, aided by Lamson, with the army forces under General Getty, and prevented General Longstreet from getting in the rear of Suffolk and capturing the Federal Army forces there. Cushing with indefatigable energy kept the Confederates from crossing the Nansemond River and reaching the rear of the defenses of Suffolk. Cushing commanded a squadron of little gun-boats and added to his reputation for gallantry and ability. The Department warmly commended him for his work on the Nansemond in general and particularly for his movement on land to Chuckatuck Village where he routed a large Confederate cavalry force. A careful study of the correspondence in Volume 8 of the Naval War Records and Volume XVIII of the Army War Records, relating to Siege of Suffolk, shows that Cushing, then under twenty-one years of age, was a strategist and a commander of ability and courage.

For his conspicuous gallantry in this desperate series of fights and elsewhere, Lieutenant Lamson, who had resigned at the close of the war, was restored, in 1895, to the Navy Register as a lieutenant on the retired list.

A small portion of the voluminous correspondence relating to Cushing's services in the Siege of Suffolk is given to indicate the hazardous nature of that campaign and the extent and quality of the operations. The zealous, efficient and cheerful lads, Cushing and Lamson, shoulder to shoulder here (and at Fort Fisher), well deserved the praise "Well done, good, faithful officers!"

Admiral Porter wrote of this affair:

> Lieutenant Cushing again, on this occasion, exhibited those high qualities which he was known to possess in so remarkable a degree, being in a fight of some kind from the time the expedition came in sight of the enemy until the latter retreated. The enemy's forces were under the command of General Longstreet, a brave and able officer, who with 10,000 men on the left bank of the river and a large force on the right bank, including strong field and siege batteries, was attempting to combine his forces and surround General Peck at Suffolk. It was Cushing who prevented the Confederates from crossing the river, and kept up the communication with the Union troops. The enemy were given no rest by the flotilla. They were frequently driven from their rifle pits, but continually returned to them with indomitable courage whenever the fire of the gunboats slacked for a moment. While Cushing was operating with his vessel, he also kept pickets on shore to present a surprise, and a party of these men captured


Map of
Nansemond River and Vicinity
showing scene of Naval Operations
in aid of army defense of Suffolk, Va.
Military lines from Army War Records Map
Union
Confederate
Statute Miles
Western Branch
Halliday's Point
NANSEMOND RIVER
Sack Point
Providence Church
Milnerstown
Hill's Pt.
Hill's Pt. Battery
Cahoon's (Cahoon's) Pt.
Glebe Point or Bush's Pt.
Reed Yard
Gen'l's Hd. Qrs.
SEABOARD AND ROANOKE R.
NORFOLK AND PETERSBURG R.
SUFFOLK
Col. Pender
FORT HALLECK
PORTSMOUTH CANAL
DISMAL SWAMP
WHITE MARSH ROAD
NORFOLK ROAD
Hd. Qrs. of General Peck

the engineer-in-chief on the staff of the Confederate General French who had come down near the gunboats with the intention of locating batteries. General Peck and General Getty both relied very much on the aid of the Navy in repulsing the Confederate attack on Suffolk, and they were largely indebted to the officers and men of the vessels for the hearty co-operation which they afforded, either by scattering the enemy with their guns, or carrying the batteries on shore by assault. This latter work was done on several occasions in the most handsome manner, the assaulting party being always led by Lieutenant Lamson. General Getty, that brave old soldier, who never failed to acknowledge merit when it came under his notice, was profuse in his acknowledgments of Lieutenant Lamson's conduct. It would require too long an account to tell the whole story of this expedition, where fighting was carried on from the 12th of April to the 23d, where the sailors took their share of the fighting on shore, and where the gunboats, under the incessant fire of the enemy were nearly knocked to pieces.

U. S. FLAGSHIP "MINNESOTA," NEWPORT NEWS, VA., April 12, 1863—4 a. m.

SIR: Proceed with the *Barney* to the lower Nansemond to assist in repelling the enemy, who are surrounding Suffolk. When there, act at your discretion. I want to see you.

Respectfully yours,

S. P. LEE,

Actg. Rear-Admiral, Comdg. North Atlantic Blockading Squadron.

LIEUTENANT W. B. CUSHING, U. S. NAVY.

Commanding U. S. S. *Commodore Barney*.

U. S. S. COMMODORE BARNEY, NANSEMOND RIVER, April 12, 1863.

SIR: I am at anchor just below the obstructions. I have been up to Suffolk and communicated with General Peck and with Lieutenant Lamson.

There are two points in the lower Nansemond where the enemy would be likely to cross. I am now off one, the other is 2 or 3 miles below. The rebels have a pontoon train, and can easily bridge the river (if not closely watched) in the night. I can only guard this position, since we can not run with the *Barney* after dark.

If, as senior officer, I have command of the vessels now in the river, I will take one from above and station it at the point below me, mentioned by General Peck. If the enemy make a fair attack in front, without attempting to cross the river, am I at liberty to lighten my vessel so as to cross the bar? At high water I can get over in 7 feet water, and then there is deep water all the way up.

If it comes to a fight, it will be a hard task to remain at anchor within sound of rebel cannon.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,

Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,

Commanding North Atlantic Blockading Squadron.

U. S. S. "COMMODORE BARNEY," NANSEMOND RIVER,
April 13—4.20 p. m.

SIR: I send a boy who deserted from the rebels day before yesterday. He has been closely questioned by me, and I am far from satisfied with his story. He first said that the Confederates took him from Petersburg day before yesterday. After a time he made the time three weeks. First said that he ran away 5 miles from Suffolk; next, that he was at the time only 2 miles from Petersburg, and finally that he ran away at both places. He once denied that he had been near Suffolk, but evidently has. I cross-questioned him strictly, and thus made him contradict himself. He is a smart boy, and I think a spy. He wants to ship, but I do not want him here, for he would desert and go back to them with information at night.

The Confederates are trying without doubt to surround General Peck. I find that there are about 10,000 men on the left bank of the river, and these are probably the flanking force. The rest of Longstreet's force is on the right bank, in rear of Suffolk. I understand that he has some siege pieces and heavy artillery. I can and will prevent them from crossing below the barricade. Some of the Confederate cavalry was in sight this morning, and women and children came down to us for protection. I have seen no point on this river that can be called a good artillery position, and have no doubt that out light boats can retain command of the Nansemond. General Peck's fortifications are of the strongest description, and he can repulse any force of the enemy. No more vessels are needed. Lieutenant-Colonel Kimball, of the Ninth New York Zouaves, was shot dead by General Corcoran night before last. I shall seize all the boats in the river until the enemy advance or retreat. I may be wrong in my opinion of this drummer boy; you can judge better than I.

Very respectfully, your obedient servant,
WM. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, Newport News, Va.

U. S. S. FLAGSHIP "MINNESOTA," NEWPORT NEWS, VA., April 13, 1863.

SIR: Yours of this date received this evening. I am highly gratified with your opinion that you can, and your determination that you will, prevent the enemy from crossing the Nansemond below the Western Branch. The width of the river there allows the *Barney* to move about and fire, which will greatly favor your efforts; but it is in the narrow, creek-like stream above the Western Branch that the light vessels are exposed to the fire of the fieldpieces and musketry, and whilst I place confidence in the intelligence of Lieutenant Lamson and the officers and crews of the *Mount Washington, Steppping Stones, Cohasset,* and *Alert,* I do not think it prudent that General Peck should exclusively rely on the invulnerability of these vessels to protect his rear, and should remove all his artillery (as he appeared to have done by Lieutenant Lamson's letter) which he had previously provided for this purpose.

It is very flattering to have the Army rely upon the Navy, but where so great a result is at stake it is proper that the general should not make the mistake of foregoing those judicious auxiliary measures necessary to secure so important a point as the protection of his rear. I expected Lieutenant Lamson to call the general's attention to the facts of the case. I shall accept your opinion that the boy you sent this evening is a spy, and shall treat him as a prisoner for the present. Relying on your opinion of your ability to keep the enemy from crossing the lower Nansemond, I revoke my order to call the *Cohasset* from above to assist, and shall so apprise Lieutenant Lamson.

Respectfully yours,
S. P. LEE,
Acting Rear-Admiral.

LIEUTENANT W. B. CUSHING, U. S. NAVY.
Commanding U. S. S. *Commodore Barney*, Lower Nansemond River.
(A copy of this sent to Lieutenant Lamson.)

U. S. S. "COMMODORE BARNEY," NANSEMOND RIVER,
Virginia, April 14 [1863]—7.30 p. m.

SIR: This morning the vessels from above came down—the *Mont Washington* disabled. About 11.30 [a.] m. the enemy fired on us with seven pieces of artillery, giving us a cross fire. At once got underway and went into action, silencing the enemy in an hour. At about 1 p. m. the rebels took up a position within 700 yards of the *Mount Washington*, which was aground, and opened on us with both artillery and sharpshooters. I kept close to the disabled steamer, and fought the enemy until high water, when I ordered the *Stepping Stones* to take the *Mount Washington* in tow. This was done under a heavy fire. At 5 p. m. I had the satisfaction of silencing the enemy's battery. My loss foots up 3 killed and 7 wounded. I do not know as yet what the casualties are in the other vessels. I have eight raking shots, but fortunately my engine is not disabled. I can assure you that the *Barney* and her crew are still in good fighting trim, and we will beat the enemy or sink at our post. I need more ammunition for 9-inch and 6-inch guns. The worst of the wounded, and the dead, I send down to the *Minnesota*. It is only requisite to look at the *Mount Washington* to see with what desperate gallantry Lieutenant Lamson fought his vessel. I am now taking in coal and shall anchor for the night where we have fought all day.

I am, sir, very respectfully, your obedient servant,
WM. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Commanding North Atlantic Blockading Squadron.

EXTRACT OF A LETTER FROM LIEUTENANT CUSHING TO HIS MOTHER.

U. S. S. "COMMODORE BARNEY," NANSEMOND RIVER,
9 p. m., April 15, 1863.

MY DEAR MOTHER: Another fight and another victory! Again I have passed through the ordeal of fire and blood, and again I thank God for

being safe in life and limb. Suffolk is besieged by the enemy, thirty thousand strong, and contains an army of fifteen thousand to defend it. The town is situated on this river, and its water communication must remain open or our force will be in a desperate position. Who do you suppose was selected to perform the dangerous task of guarding the rear and preventing the crossing of ten thousand of the flower of the Southern army? Who but your son! That ex-midshipman, ex-master's mate, hair-brained, scapegrace, Will Cushing! Yes, it is even so, I am senior officer, commanding in the Nansemond River. I have my vessel and two others now. I had two more, but they were disabled in action, and have been towed to Hampton Roads. I am six miles from the city, at a placed called Western Branch, the point most desired by the enemy. I draw too much water to go up further, but send my light boats up above. Yesterday morning, as they were on their way down, they encountered a battery at a distance of three hundred yards, and swarms of riflemen in the bushes on the banks. A sharp action ensued, in which two of the boats were disabled, and but one left uninjured, but the captain of her, like a brave fellow as he is, got them around the point out of range and we managed to get them as far as the bar here, when one, the *Mount Washington*, got aground. The rebels soon appeared in force, bent upon driving us and crossing the river. They opened with artillery from two positions, a cross fire, and their seven pieces sent a hail of shot and shell around us. I had but two vessels afloat, but I silenced their fire in an hour. In a short time they again went into action; this time unmasking a regularly constructed battery not five hundred yards from us, and so situated as to rake the narrow channel completely. It was impossible to get our disabled steamer off from the bar until high water, five hours ahead, and I determined to fight on the spot as long as the *Barney* was above the water. I sent the light steamer down to guard another coveted point, and was soon exchanging death calls with the enemy.

Well, it was a hard fight, and at close quarters most of the time; so close that their infantry riddled the two vessels with bullets. *Crash!* go the bulkheads—a rifle shell was exploded on our deck, tearing flesh and woodwork. A crash like thunder is our reply—and our heavy shell makes music in the air, and explodes among our traitor neighbors with a dull sullen roar of defiance. Up goes the battle flag, and at once the air is filled with the smoke of furious battle, and the ear thrills with the unceasing shriek and whistle of all the shell and rifle bolts that sinful man has devised to murder his fellow-creatures. *Crash! Crash!* Splinters are flying in the air; great pools of blood are on the deck, and the first sharp cry of wounded men in agony rises upon the soft spring air. The *dead* cannot speak—but there they lie motionless, lifeless, and mangled, who a moment ago smiled on the old flag that floated over them, and fought for its glory and its honor. Sprinkle ashes over the slippery deck—the work must still go on. The rifled gun—my best—is disabled, for three shots have struck it—the muzzle is gone, the elevator is carried away, and the carriage is broken. Steady, men, steady! Fill up the places of the killed and wounded—don't throw a shot away. The wheel of the howitzer is torn off by the shell, and the gun rendered useless—never mind! Work the remaining guns *with a will* —for we can and *must* be victorious. And so the time wore away, until

the rising river promised to release the imprisoned steamer, when I signaled to the light steamer to move up and take her in tow. This duty was gallantly performed and the old *Barney* remained alone under the rebel cannon.

And here let me pause to give credit to one who will never earn more glory than he grasped in our desperate combat then. Lieutenant Lamson is one of the class below me, and commanded the disabled steamer *Mount Washington*. When his vessel was aground on the bar he fought her with the most determined and desperate courage. Not heeding the iron storm that was fast destroying his command, he answered gun for gun the enemy's fire, and came out of the five hours fight with torn planks and leaking timbers, but covered with glory. I fought within a hundred yards of him and we are sworn friends for life. Well I silenced the battery, and anchored at night where I had fought all day, at my post.

My vessel is riddled with cannon balls and bullets, and I have lost three killed and nine wounded—four of them mortally—men who lost legs and arms. The loss on the other vessels is proportionately severe. I am no braggart, but I challenge the world to furnish a more determined fight, or a victory more richly earned. The enemy *shall* not *cross* here. I will not give way one inch. Even now the thickets on the banks are alive with their sharpshooters; and as I write the quick whirr of the riflet bullet is often heard, sent from the banks five hundred yards ahead, in the vain hope of injuring the hated Yankee. A good providence seems to watch over my fortunes, though I do not deserve its protection. I may go into action again at any moment, probably to-morrow.

U. S. S. "COMMODORE BARNEY," NANSEMOND RIVER, WESTERN BRANCH,
April 17 (1863)—9 p. m.

SIR: At high water this morning I started the *Alert, Coeur de Lion*, and *Teaser* up the river. The *Alert* passed up safely, but the *Teaser* and *Coeur de Lion* grounded. I got the first named of the two off an hour or two ago; the second got off before noon and was sent up the river this evening. The *Teaser* has in some way disabled the engine, and I am forced to send her down. I shall order the *Yankee* up at 9 in the morning, though I think it dangerous to do so, since she cannot be guided by the helm when in the mud. We will lighten her as much as possible, and if she goes ashore under the fire of the battery I will protect her as much as possible. The *Primrose* cannot go up in any event, but is of the greatest importance below. I have pickets ashore on this bluff, in order that I may not be surprised by the enemy, and in order that my officers may not be picked off from the brush. This forenoon two of my men captured the engineer-in-chief on the staff of the rebel Major General French. He came down within 300 yards of the boats to make a reconnoissance, no doubt intending to locate rifle pits and batteries. He was accompanied by a citizen, armed, who made his escape. The people living in this vicinity aid the rebels in every way, and do not scruple to fire at our men. If I take one with arms in his hands trying to kill my men, I will not take him prisoner. Please bear in mind that this officer was captured below Western Branch Creek,

which fact goes to prove that General French is on duty below my position; in fact, I am aware that he dined with his staff in the village of Chuckatuck, some distance below, and from the shore I also received information that a brigade is located 3 miles inshore from Sleepy Hole, and that they are constructing a masked battery there. I have sent the *Yankee* and *Zouave* there to-night, and have stationed the *Primrose* at Bush's Point, another dangerous spot. I remain in my old position with this vessel, within 700 yards of the battery and rifle pits. The Confederates have thrown up so much earth fronting me that I can do them very little injury by my fire. Their three guns bear on a point in the channel just above the bar, and seem to be stationary. I judge so from the fact that they did not fire on the *Teaser* during the five hours that she lay helpless within 500 yards of the fort, but they fired on the *Alert* just as she reached a certain point not 50 yards from the *Teaser*, and also on the *Coeur de Lion* this evening when at the same point, and when they passed this spot the firing ceased, though they would have been for some time within range of an ordinary battery. I am confident that these are pieces that I have disabled by knocking the carriages in pieces, and that they have so placed them that they bear on one point, and have wedged them in that position. If I could get directly in their front I could break them up in fifteen minutes, but they are behind a high bank of earth and do not bear on me at all.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,
Lieutenant, Commanding

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, Newport News.

U. S. S. "COMMODORE BARNEY," NANSEMOND RIVER, WESTERN BRANCH,
April 17 (1863)—10 p. m.

SIR: There is one thing that I neglected to state in my dispatch written an hour ago. The expedition that was to capture the rifle pits failed in consequence of the army men being frightened at nothing. Two hundred men were landed by the *Stepping Stones;* they remained ashore five minutes and saw three rebel pickets running away, which so frightened them that they returned without firing a shot. If you can send me two launches with smoothbore 12-pounder howitzers or others, I will agree to capture the battery and rifle pits on the bank ahead and spike the guns. As the cannons are stationary, but few men are needed in their works, and I am confident that they can be driven out, killed, or captured by a close attack with launches in front and flank, and then a sudden land charge with about fifty men. Just after dark would be my time for attack, when the few men in the rifle pits cannot pick the men off the launches. It is important that these guns should be spiked, since every steamer going up has to pass the point on which they bear, and some must get disabled. Their position is such that the few rebels there could not get assistance in time to repel a sudden and vigorous attack. If this is not done the artillery will soon be repaired with new wheels or other disabled portions, and thus their force will regain several rifled pieces that cannot now be used in the field. That

captured engineer officer, whose name is Rogers, admits that the cars are running on the railroad. I knew that I could not be mistaken. I learn many of these points in advance of the army, and will try to give you reliable information. I shall take most of the men from the *Teaser* before sending her down, as I am short-handed in consequence of deaths, wounds, and five men lent to Captain Harris.

I am, sir, very respectfully, your obedient servant,

W. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, Newport News, Va.

(Telegram.)

SUFFOLK, April 19, 1863—8 p. m. (Received 11.30 p. m.)

General Getty landed to-day with Lieutenant Lamson, 300 men and four boat howitzers at the point of junction with Western Branch and Nansemond. Captured five pieces of artillery and 161 rebel prisoners, Forty-fourth Alabama. General Getty holds the place, intends to fortify it. Is throwing re-enforcements. He wants assistance of the gunboats for the present. I await further orders.

PIERCE CROSBY,
[Fleet] Captain.

ACTING REAR-ADMIRAL S. P. LEE,

ORDER OF ACTING REAR-ADMIRAL LEE, U. S. NAVY, TO LIEUTENANT CUSHING, U. S. NAVY, REGARDING VESSELS IN UPPER NANSEMOND.

U. S. FLAGSHIP "MINNESOTA," NEWPORT NEWS, VA.,
April 19, 1863—11.30 p. m.

SIR: Captain Crosby's dispatch from Suffolk informs me of General Getty's success. Congratulate the general for me. I willingly assist him and let the gunboats remain. He is of the right sort. I think, however, he would have done well to have shinned over to his own side for the night, as it is dark, unless he got into position in time to secure himself. At 4 a. m. I will send this in by the *Philadelphia*.. Send her back with a report of the situation and your wants, if any. If practicable send me the *Cohasset* in the morning and let the *Zouave* take her place. If we hold the battery this can easily be done. I require a tug.

Respectfully yours,

S. P. LEE,
Acting Rear-Admiral.

LIEUTENANT W. B. CUSHING, U. S. NAVY.
Comdg. *Commodore Barney*, Nansemond River.

U. S. FLAGSHIP "MINNESOTA," NEWPORT NEWS, VA., April 20, 1863.

Well done, good, faithful officers! The flotilla need not return to the upper Nansemond (the enemy being in retreat, as reported by Lieutenant

Cushing), except the *Stepping Stones*. She may resume her usual position in the river. Lieutenant Lamson may return when he sees fit. Mail is closing. In great haste.

S. P. LEE,
Acting Rear-Admiral.

LIEUTENANTS CUSHING and LAMSON.

U. S. S. "COMMODORE BARNEY," WESTERN BRANCH NANSEMOND RIVER,
April 20 (1863)—8 a. m.

SIR: Another battery, heavier than the first, has been unmasked by the enemy. I engaged it yesterday, until I was taken in the flank at close quarters by a sharp fire of musketry across our decks. I drove them from the woods and again engaged the battery while our force was in sight taking the fort. My loss was one man mortally wounded, who died last night, and whose body I send to the *Philadelphia*. This vessel was struck but once (in the hull) by shell, though they burst all around at a distance of 20 yards either side. Unlike their firing of the 14th, their shell now burst with great precision. The pieces in this battery are all rifled, as were those on the captured point on the day we engaged it. One is a 50 or 100 pounder rifled, and the others are from 20s to 12s. It is so masked that I have only their smoke to fire at. I engage it to-day at 12 m., and if I do not get a shot in my exposed magazine shall hope to silence it before night. I shall extend your congratulations to Lieutenant Lamson (as well as General Getty), to whom all the credit is due for yesterday's gallant exploit—the capture of the battery in our front.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Commanding North Atlantic Blockading Squadron.

U. S. S. "COMMODORE BARNEY," NANSEMOND RIVER, WESTERN BRANCH,
April 21, 1863—1.35 a. m.

SIR: When I said yesterday that the enemy had withdrawn from our front I intended to convey the idea that the battery that I was going to engage had been abandoned during the night. I might have added that I had every reason to believe that the whole rebel army is in retreat. My opinion coincided with that of General Getty. Last night our troops evacuated the fort in my front by order of General Peck. I protested against an act that would close the river if the enemy were in earnest; but the rebel pickets now hold it. Our land force fortified it strongly in the rear and left their works for the rebels to use. I do not see how such a movement can be justified. You are mistaken in believing the captured guns to be the ones used against us on the 14th. They (those used then) were rifled guns, and we have some of their shell on board. We disabled that battery and it was replaced by this. I confess that when I looked at

the works and saw their great strength I was astonished that we silenced them on that day. I think that active work is nearly over in this quarter.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Commanding North Atlantic Blockading Squadron.

U. S. S. "COMMODORE BARNEY," SLEEPY HOLE, NANSEMOND RIVER,
April 23, 1863—12 a. m.

SIR: I have the honor to report that on the 21st I received information from Captain Harris, of the *Stepping Stones*, then anchored at this station, that a boat's crew of five men had been killed or captured by the enemy under the following named circumstances: At 11 a. m. on that day a white handkerchief was waved on the rebel shore by a man dressed in citizen's clothes, and thinking the person to be a Mr. Wilson, and wishing to gain information as to the state of the country, Captain Harris sent in a boat containing five men to bring him off. As soon as the boat reached the beach it was fired upon by persons concealed in the brush. The fire was returned from the boat and the *Stepping Stones* opened from her howitzers. Upon learning of this treacherous act, I determined to so punish it that we should not suffer so in future. On the morning of the 22d we moved down from Western Branch with the *Yankee* in company and anchored near the *Stepping Stones*. I at once proceeded to organize a boat expedition, and at 1.45 p. m. seven boats left the side of the *Barney*, two belonging to that vessel, three from the *Yankee*, and two from the *West End* (army boat). The crews were made up of details from the several vessels present and numbered about ninety men. We pulled in boats in line abreast and covered by the fire of the boats, and landed the men and one 12-pounder howitzer. The boat sent in the day before was secured, together with four muskets and the dead body of Rietchurch, seaman of *Minnesota*.

Leaving a party to guard the boats, I advanced and, throwing out a line of skirmishers in front, burned three houses, with barns, etc., owned by men who had given active service to the rebel cause while wearing the dress of private citizens. All the buildings were on the point of land from which the enemy fired on the 21st.

As soon as this was done our force advanced on Chuchatuck village, 3 miles distant, at which point 400 cavalry were said to be posted. We came upon their pickets about a mile and a half from the town and drove them in, and, having secured a mule cart, toggled the trail rope of the howitzer to the rear and went forward at a double-quick. My object was, if possible, to re-capture our men and to punish the rebels for their cowardly conduct. Two other squads of their pickets were driven in, and at 4.30 we entered the town. Suddenly a party of cavalry, numbering about forty men, appeared some 200 yards in our front, coming down the street at a saber charge. The howitzer was at once unlimbered and discharged, and my men opened with musketry. At this the mules became frightened

Cushing), except the *Stepping Stones*. She may resume her usual position in the river. Lieutenant Lamson may return when he sees fit. Mail is closing. In great haste.

S. P. LEE,
Acting Rear-Admiral.

LIEUTENANTS CUSHING and LAMSON.

U. S. S. "COMMODORE BARNEY," WESTERN BRANCH NANSEMOND RIVER,
April 20 (1863)—8 a. m.

SIR: Another battery, heavier than the first, has been unmasked by the enemy. I engaged it yesterday, until I was taken in the flank at close quarters by a sharp fire of musketry across our decks. I drove them from the woods and again engaged the battery while our force was in sight taking the fort. My loss was one man mortally wounded, who died last night, and whose body I send to the *Philadelphia*. This vessel was struck but once (in the hull) by shell, though they burst all around at a distance of 20 yards either side. Unlike their firing of the 14th, their shell now burst with great precision. The pieces in this battery are all rifled, as were those on the captured point on the day we engaged it. One is a 50 or 100 pounder rifled, and the others are from 20s to 12s. It is so masked that I have only their smoke to fire at. I engage it to-day at 12 m., and if I do not get a shot in my exposed magazine shall hope to silence it before night. I shall extend your congratulations to Lieutenant Lamson (as well as General Getty), to whom all the credit is due for yesterday's gallant exploit—the capture of the battery in our front.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Commanding North Atlantic Blockading Squadron.

U. S. S. "COMMODORE BARNEY," NANSEMOND RIVER, WESTERN BRANCH,
April 21, 1863—1.35 a. m.

SIR: When I said yesterday that the enemy had withdrawn from our front I intended to convey the idea that the battery that I was going to engage had been abandoned during the night. I might have added that I had every reason to believe that the whole rebel army is in retreat. My opinion coincided with that of General Getty. Last night our troops evacuated the fort in my front by order of General Peck. I protested against an act that would close the river if the enemy were in earnest; but the rebel pickets now hold it. Our land force fortified it strongly in the rear and left their works for the rebels to use. I do not see how such a movement can be justified. You are mistaken in believing the captured guns to be the ones used against us on the 14th. They (those used then) were rifled guns, and we have some of their shell on board. We disabled that battery and it was replaced by this. I confess that when I looked at

the works and saw their great strength I was astonished that we silenced them on that day. I think that active work is nearly over in this quarter.

I am, sir, very respectfully, your obedient servant,

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Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
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SIR: I have the honor to report that on the 21st I received information from Captain Harris, of the *Stepping Stones*, then anchored at this station, that a boat's crew of five men had been killed or captured by the enemy under the following named circumstances: At 11 a. m. on that day a white handkerchief was waved on the rebel shore by a man dressed in citizen's clothes, and thinking the person to be a Mr. Wilson, and wishing to gain information as to the state of the country, Captain Harris sent in a boat containing five men to bring him off. As soon as the boat reached the beach it was fired upon by persons concealed in the brush. The fire was returned from the boat and the *Stepping Stones* opened from her howitzers. Upon learning of this treacherous act, I determined to so punish it that we should not suffer so in future. On the morning of the 22d we moved down from Western Branch with the *Yankee* in company and anchored near the *Stepping Stones*. I at once proceeded to organize a boat expedition, and at 1.45 p. m. seven boats left the side of the *Barney*, two belonging to that vessel, three from the *Yankee*, and two from the *West End* (army boat). The crews were made up of details from the several vessels present and numbered about ninety men. We pulled in boats in line abreast and covered by the fire of the boats, and landed the men and one 12-pounder howitzer. The boat sent in the day before was secured, together with four muskets and the dead body of Rietchurch, seaman of *Minnesota*.

Leaving a party to guard the boats, I advanced and, throwing out a line of skirmishers in front, burned three houses, with barns, etc., owned by men who had given active service to the rebel cause while wearing the dress of private citizens. All the buildings were on the point of land from which the enemy fired on the 21st.

As soon as this was done our force advanced on Chuchatuck village, 3 miles distant, at which point 400 cavalry were said to be posted. We came upon their pickets about a mile and a half from the town and drove them in, and, having secured a mule cart, toggled the trail rope of the howitzer to the rear and went forward at a double-quick. My object was, if possible, to re-capture our men and to punish the rebels for their cowardly conduct. Two other squads of their pickets were driven in, and at 4.30 we entered the town. Suddenly a party of cavalry, numbering about forty men, appeared some 200 yards in our front, coming down the street at a saber charge. The howitzer was at once unlimbered and discharged, and my men opened with musketry. At this the mules became frightened

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Leaving a party to guard the boats, I advanced and, throwing out a line of skirmishers in front, burned three houses, with barns, etc., owned by men who had given active service to the rebel cause while wearing the dress of private citizens. All the buildings were on the point of land from which the enemy fired on the 21st.

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and charged directly into the rebel ranks, taking with them the most of our howitzer ammunition. As soon as the gun was discharged our sailors went forward with a cheer, drove the enemy, and repossessed themselves of the cart and ammunition.

The rebels retreated with the loss of two killed and three horses, fully equipped, captured; also six cavalry pistols. We remained masters of the town. Finding that the captured sailors had been taken to the Confederate headquarters across Reed's Ferry, I started for the river at 5.15 p. m. and reached the boats safely at 7, having a slight skirmish by the way. I lost one man killed in the cavalry charge (Daniel Conlow, landman), who, being slightly in advance, fired right in the face of the advancing force and was shot in two places. I send his body by the *Coeur de Lion*, as also the corpse of the man killed on the 21st. This has been a most important reconnoissance, and has, I think, demonstrated that the rebels are not in strong force near Suffolk. I shall communicate the result to General Peck at once. Acting Master's Mate, James Birtwistle, of the *Minnesota*, behaved as usual with the coolest bravery in working the howitzer, and certainly deserves promotion if gallantry and strict attention to duty merit such reward. Acting Ensign William Hunter had charge of the advance guard, and did his whole duty. Acting Master's Mate G. M. Lawrence, of the *Stepping Stones*, acting as guide, and may justly claim great credit for his share in the expedition. Master's Mate Aspinwall took charge of the boats, and took all citizens near prisoners, in order that no information of our movements might be taken to the enemy. Acting Master's Mate Borden, from the *Yankee*, took charge of the main body under myself, and did his duty. When I entered the town I had with me about half of the men, as I had to leave a force at the crossroads to protect my rear. I cannot refrain from drawing a contrast between the conduct of the sailors, who behaved most nobly, with that of the fifteen soldiers from the *West End*, whom I was obliged to threaten in order to make them do their duty.

I am, sir, very respectfully, your obedient servant,

W. B. CUSHING,

Lieutenant and Senior Officer in Nansemond.

ACTING REAR-ADMIRAL S. P. LEE,

Comdg. North Atlantic Blockading Squadron, Newport News, Va.

NAVY DEPARTMENT, April 24, 1863.

SIR: I have received your despatch No. 448, with the enclosures. The course pursued by you, as disclosed by your orders to Lieutenants Cushing and Lamson and your correspondence with Major-General Dix, was judicious and is approved by the Department.

Great credit is due Lieutenants Cushing and Lamson and their commands for the courage, skill, and energy displayed by them and their officers and men in an emergency requiring the exercise of undaunted bravery and resolution. The naval forces have well sustained themselves in the trying circumstances in which they have been placed and borne themselves in a manner deserving commendation. It is to be regretted that the battery which they captured, and which was the key of the

position above, should have been abandoned, unless under compulsory necessity. You have every reason to be satisfied with your own course, and also with that portion of your command which participated in these conflicts and so faithfully executed your orders.

Very respectfully, etc.,

GIDEON WELLES,
Secretary of the Navy.

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, Old Point Comfort.

U. S. FLAGSHIP "MINNESOTA," off NEWPORT NEWS, VA.,
April 25, 1863.

SIR: I beg leave to enclose for the information of the Department certified copies of the several reports by Lieutenants W. B. Cushing and R. H. Lamson respecting our operations in the lower and upper Nansemond during the recent demonstration of the enemy against Suffolk.

The Department will perceive on perusal of these interesting narratives that these young officers, in the extremely difficult and hazardous positions in which they have been placed, have exhibited remarkable zeal, courage, and discretion, and that the officers and men under their command have faithfully and gallantly supported them.

I hope the Department will also especially notice Lieutenant Cushing's gallantry and enterprise in conducting an important armed reconnoissance with ninety men from the gunboats and a 12-pounder howitzer, 3 miles into the enemy's country to Chuckatuck village, where a force of cavalry was put to flight and a safe return to the gunboats effected after a brief occupation of the town.

I have the honor to be, sir, very respectfully yours,

S. P. LEE,
Actg. Rear-Admiral, Comdg. North Atlantic Blockading Squadron.

HON. GIDEON WELLES,
Secretary of the Navy, Washington, D. C.

NAVY DEPARTMENT, May 4, 1863.

SIR: Your gallantry and meritorious services during the recent demonstration of the enemy upon the Nansemond and in co-operating with the army are entitled to the especial notice and commendation of the Department. Your conduct on this occasion adds additional luster to the character you have already established for valor in the face of the enemy.

The energy and ability displayed by yourself and the officers and men under your command in the defense of the the lower Nansemond are most creditable and are appreciated by the Department.

The Department desires to express to you more especially its admiration of your gallantry and enterprise in conducting an important armed reconnoisance with a party from the gunboats some miles into the enemy's country to the village of Chuckatuck and putting to flight a body of rebel cavalry and safely returning to your vessel.

Accept my congratulations for yourself and the officers and men that were under your command.

Very respectfully, etc.,

GIDEON WELLES,
Secretary of the Navy.

LIEUTENANT W. B. CUSHING, U. S. NAVY.
Commanding U. S. S. *Commodore Barney*, Old Point Comfort.

SUFFOLK, VA., May 5, 1863.

COLONEL: . . . On the 14th Lieutenant Cushing, U. S. Navy, was hotly engaged for several hours with a large force at the mouth of the Western Branch. His loss was severe, but the enemy suffered much and had some artillery dismounted. The enemy opened a 10-gun battery near the Norfleet house for the purpose of destroying the gunboats and of covering a crossing. Lieutenant Lamson, with the *Mount Washington, West End,* and *Stepping Stones,* engaged the battery for some hours in the most gallant manner, but was compelled to drop down to the Western Branch. The *Mount Washington,* completely riddled and disabled, grounded, as did the *West End,* and both were towed off by the *Stepping Stones.* The rudder of the *Alert* was broken.

General French's engineer was taken prisoner by Lieutenant Cushing's pickets. He was laying out works and had a map of Suffolk, which he tore to pieces.

On the 18th the enemy was very active in throwing up new batteries and rifle pits along the river. A heavy one was in progress near the mouth of Western Branch on Hill's Point. Admiral Lee, U. S. Navy, ordered all the boats out of the upper Nansemond, lest they should be destroyed, leaving the whole defense of the river to the land forces. The admiral was urged to reconsider his orders. Upon my representation the order was temporarily suspended.

May 4.—About 9 p. m. on the 3d the enemy commenced retiring upon the Blackwater. His strong line of pickets prevented deserters and contrabands from getting through with the information until he had several hours the start.

Thus ends the present investment or siege of Suffolk, which had for its object the recovery of the whole country south of the James, extending to the Albemarle Sound in North Carolina, the ports of Norfolk and Portsmouth, 80 miles of new railroad iron, the equipments of two roads, and the capture of all the United States forces and property, with some thousands of contrabands.

The co-operation of the gunboats, under Lieutentants Cushing, Lamson, and Harris, U. S. Navy, sent by Admiral Lee, has been very effective and I take great pleasure in acknowledging the gallant services of their officers and crew. Very respectfully, your obedient servant,

JOHN J. PECK,
Major-General.

COLONEL D. T. VAN BUREN,
Assistant Adjutant-General, Department of Virginia.

REPORT OF LIEUTENANT CUSHING, U. S. NAVY, COMMANDING U. S. S. "SHOKOKON," REGARDING THE DESTRUCTION OF THE "HEBE."

U. S. S. "SHOKOKON," off WILMINGTON, N. C., August 24, 1863.

SIR: I have the honor to report that early on the morning of the 18th I discovered a steamer ashore about 8 miles to the northward of Fort Fisher. Stood in and found to to be the Anglo-rebel steamer *Hebe*. She was on the beach, and the gunboat *Niphon* was near, making preparations to board her. One of the *Niphon's* boats succeeded in going alongside, but was stove, leaving the crew on the deck of the prize. It was blowing a gale from the northeast, making it a lee shore for us, and in the heavy sea two more boats belonging to the *Niphon* were swamped and their crews either shot, drowned, or taken prisoners by the enemy, who kept up a constant fire from infantry and artillery. I now sent a boat in and succeeded in rescuing two of the *Niphon's* men.

After throwing a shell into the *Hebe* forward to warn the three men left on her deck to leave her, and having seen them reach the beach, we commenced a heavy fire, that soon riddled her. Twice she was on fire from our shells, and twice the sea extinguished the flames, but just after a shell exploded abaft the smokestack her decks blazed up and continued to burn until she was a wreck. Our fire was kept up at from 100 to 300 yards' range. The rebel artillery was used against us about four hours, but all their shell passed over us and did no injury. The vessel was somewhat marked by musket bullets.

I am, sir, very respectfully, your obedient servant,

W. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Commanding North Atlantic Blockading Squadron.

DESTRUCTION OF THE BLOCKADE RUNNER "ALEXANDER COOPER."

U. S. FLAGSHIP "MINNESOTA," off WILMINGTON, N. C.
August 28, 1863.

SIR: I transmit enclosed the interesting report of Lieutenant Cushing respecting the destruction of the blockade running schooner *Alexander Cooper*, in New Topsail Inlet, on the 22d instant.

Lieutenant Cushing had previously communicated his plan to me and received my authority for undertaking it. This was a handsome affair, showing skill and gallantry. I regret that the contrabands who, under orders, assisted our little band, and thereby were compromised, could not have been brought off.

I recommend Mr. Cony for promotion to acting master and approve of Lieutenant Cushing's recommendation to promote Robert [T.] Clifford to master's mate.

I have the honor to be, very respectfully,

S. P. LEE,
Actg. Rear-Admiral, Comdg. North Atlantic Blockading Squadron.

HON. GIDEON WELLES,
Secretary of the Navy, Washington, D. C.

(Endorsement.)

Give Clifford a medal and promote to acting master's mate; appointed September 7. Promote Cony; promoted September 7.

(Enclosure.)

U. S. S. "SHOKOKON," off WILMINGTON, N. C., August 25, 1863.

SIR: I have the honor to report that we have destroyed the blockade running schooner *Alexander Cooper* under the following circumstances:

On the 12th I made a reconnoisance with boats in New Topsail Inlet and was driven out by the fire of four pieces of rebel artillery stationed opposite the mouth, but not before I had discovered a schooner at a wharf some 6 miles up the sound. This schooner I determined to destroy, and as it was so well guarded I concluded to use strategy. On the evening of the 22d the *Shokokon* anchored close into the sea beach about 5 miles from the inlet and I sent ashore two boat's crews, who shouldered the dingey and carried it across the neck of land that divides the sea from the sound. This was about half a mile in width and covered with a dense thicket. The crossing placed my men some miles in the rear of the artillery force guarding the entrance. The dingey being launched on the inside waters, 6 men, under my executive officer, Acting Ensign Jos. S. Cony, started with orders to destroy or capture anything that could be of use to the enemy. Now, it seems that a 12-pounder howitzer was stationed at the point from which we were aiming, and the smokestack of my steamer having been seen over the trees, the commandant of the post, Captain Adams, had come down from the main camp to insure a bright lookout.

While the rebels at the schooner's mastheads were straining their eyes in looking to the southward, my boat was approaching in the other direction, and the men succeeded in landing about 50 yards from the wharf, without being discovered. The master-at-arms, Robert Clifford, crept into the rebel camp and counted the men, and having returned to his shipmates, a charge was ordered, and our 7 men bore down on them with a shout. In a moment the enemy, who outnumbered us 3 to 1, were routed, leaving in Mr. Cony's possession 10 prisoners, including Captain Adams and Lieutenant Latham, one 12-pounder army howitzer, 18 horses, 1 schooner, and some extensive salt works.

Mr. Cony then threw out two pickets, detailed two men to guard the prisoners, and with the remaining 2, fired the vessel and salt works; these were thoroughly consumed.

The object of the expedition being accomplished, my men returned to this vessel without loss, bringing with them 3 of the prisoners, all that the boat would contain.

The rebel officers and privates were dressed alike, and Mr. Cony was at a loss to know what three to retain. He settled the matter, however, by picking out the three best looking ones, who all turned out to be privates. So the officers owed their safety to their lack of physique, a new feature in military strategy.

While this was going on at the mainland, my pickets on the beach side, under Acting Master's Mate Proudfit, engaged and repulsed the rebel picket force in that quarter without loss on our side. The manner in which my

orders were carried out is highly creditable to Mr. Cony, who is, I beg leave to state, a good officer, seaman, artillerist, and navigator. The names of the men who made this daring charge are: Robert T. Clifford, master-at-arms; James Wallingford, captain forecastle; Henry Mansfield, coxswain; Herman P. Loss, Edward Brett, Henry Vonversen, ordinary seamen.

Clifford has volunteered upon no less than four occasions of danger since I have been aboard and never fails to do his duty. He is qualified for promotion to master's mate. All are good men.

This schooner cleared from New York for Port Royal, S. C., with an assorted cargo, and was towed once outside the line of blockade by a gunboat. I shall try to learn the names of the patriotic citizens of my State who entered into this little speculation.

I am, sir, very respectfully, your obedient servant,

W. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, off Wilmington, N. C.

Admiral Porter wrote of this event:

The object of the expedition having been accomplished, the men returned to their vessel, taking with them three prisoners, all that the boat would hold. The Confederate officers and men were all dressed alike, and Mr. Cony could not tell them apart, so he was at a loss to know which to retain. He settled the matter by picking out the three best looking, who all turned out to be privates.

This performance almost sounds like romance, but Cushing's officers were all animated with his spirit, and were always ready to undertake anything, no matter how hazardous. As many risks were run, and as many dangers faced, as fell to Decatur's lot when he cut out the *Philadelphia* in Tripoli harbor.

Cushing's cool account of testing an old river steamer in a severe gale at sea met with the approval of his squadron commander. This test was made under the eye of Rear-Admiral Lee.

U. S. FLAGSHIP "MINNESOTA," off WILMINGTON, N. C., August 28, 1863.

SIR: I enclose the report of Lieutenant William B. Cushing, commanding the U. S. S. *Shokokon*, of this date, from which, and the verbal reports of that zealous and able young officer, it appears that the *Shokokon* was near being lost in the severe gale of yesterday. The gale backed from the East to N. N. W., and blew a hurricane for nearly four hours.

I send the *Shokokon* to Hampton Roads, and have authorized Lieutenant Cushing to report in person to the Department, in the belief that the Department will cheerfully assign him to a swift and staunch steamer and immediately return him to my command for present duty on the blockade of Wilmington. I have the honor to be, very respectfully,

S. P. LEE,
Actg. Rear-Admiral, Comdg. North Atlantic Blockading Squadron.

HON. GIDEON WELLES,
Secretary of the Navy, Washington, D. C.

(Endorsement.)

This vessel (*Shokokon*) was the new *Clifton*, purchased from Mr. Law, and similar to the *Clifton*, now in the service. Length, 181 feet; beam, 32 feet; hold, 13 feet.

JOHN LENTHALL.

(Enclosure.)

U. S. S. "SHOKOKON," off WILMINGTON, N. C., August 28, 1863.

SIR: I have the honor to report that, having tested this vessel's sea-going qualities in a gale of wind, I do not deem her fit for blockading service. In yesterday's blow I just managed to get her to the anchorage under the lee of Frying Pan Shoals, and it is my opinion that if she had been 10 miles farther off land she would have gone down.

Her condition at present is as follows: Sponsons torn off or crushed, forward decks started and seams opened, forward ports carried away, and sternpost split. During the gale her wood ends opened about half an inch.

She now leaks to the extent of 450 gallons a minute. When struck by a sea forward she seemed to give and bend like india rubber. This I judge to be caused by a weakness of the beams, they not being sufficiently set by knees.

I am, sir, very respectfully, your obedient servant,

W. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, off Wilmington, N. C.

NAVY DEPARTMENT, October 19, 1863.

SIR: Proceed to Hampton Roads, Virginia, with the U. S. S. *Monticello* and report to Acting Rear-Admiral Lee for duty in the North Atlantic Blockading Squadron.

Very respectfully, etc.,

GIDEON WELLES,
Secretary of the Navy.

LIEUTENANT WILLIAM B. CUSHING,
Commanding U. S. S. *Monticello*, Philadelphia.

The little *Monticello* under Cushing was on blockade duty and performed that onerous service with credit. During a shifting of the blockading vessels the *Monticello* collided with and sunk the U. S. S. Peterhoff, formerly as a blockade-runner famous in international law cases. For this Cushing was exonerated and the officer-of-the-deck held blameworthy. The blockade of the Confederate coast in the Civil War has never been fully brought

before the public. The blockade of Wilmington was specially hazardous. The town is on Cape Fear River about twenty-seven miles from its mouth. There were two mouths, New Inlet to the eastward and Western Bar Channel 6 miles to the South'ard. Between the two mouths lay Smith's Island with its southern extremity, Cape Fear projecting to seaward and continuing as a shoal ten or twelve miles, making the outside distance between the entrances nearly forty miles. The only protection against gales was to be found in the lee of Frying Pan Shoals, and at the lower mouth near the heavy guns of Fort Caswell. At New Inlet were the heavy fortifications of Fort Fisher that commanded the channel

U. S. S. "MONTICELLO."

and ocean front from well above Federal Point to Caroline Shoals below the Inlet. This great fortress was constructed and commanded by an able, zealous and gallant soldier, Colonel William Lamb, C. S. A., and it was the scene of a desperate conflict in the later days of the war when its capture by the navy and army closed Wilmington as a Confederate port. Smithville, a small town above Fort Caswell was the point of departure of blockade-runners. Dropping down from Wilmington they could here wait their opportunity to proceed to sea by either entrance, aided by the range-lights, channel boats, and at the most favorable moment. Each of the blockading squadrons at New Inlet and Western Bar, obliged in daylight to keep out of range of Fort Fisher and Fort

Caswell, respectively, were stationed in a curve with extremities nearer shore. The forts were vigilant, and if a blockader ventured within range a rifle shell gave warning to keep his distance. At night the blockaders were pressed closer in and were withdrawn at dawn to their daylight stations. The blockade runners would make the land near night-fall, and with growing darkness would dash full-speed through the fleet, and in a few minutes would be safe from capture under the protection of the guns of the fort. Here blockade-running was at its height in 1863 and 1864, and many rich cargoes passed to and from the Confederacy. The blockader's life was a hard one. To the seaward was the broad ocean, its blighting gales and tumbling billows. To the leeward a flat shore of sand and shoal, high-power guns and high-grade gunners. To the dread of a lee shore and its breakers and its forts was added the fear of loathsome prison life and prison fare for the survivors if a blockader should go ashore. In this bitter service the flower of our navy kept watch night and day, for weeks and months and years. Here, at Wilmington, Cushing with his usual energy and enterprise kept guard and here he performed, in February and June, 1864, two daring exploits that gained him wide fame. The stern patriarch at Washington expressed his gratification and gave that faint praise which has sometimes marked his lack of appreciation of his junior officers. In his "Diary," recently published, there is one mention of Cushing, viz: that President Lincoln laughed heartily over the mock monitor employed by Cushing in Cape Fear River.

Cushing's boat expedition of February 29, 1864, into Smithfield, N. C., the armed camp of the enemy, to capture the commanding general, was a dashing success that thrills the heart. To enter this armed camp of a regiment, visit its headquarters and capture the senior officer present appears so audacious that one can hardly believe that it was successfully done by a youngster of twenty-one. The absence of the Confederate general was that officer's good fortune and in no wise lessens the credit due to Cushing for his bravery.

BOAT EXPEDITION TO SMITHVILLE, N. C., FOR THE PURPOSE OF CAPTURING THE COMMANDING GENERAL, FEBRUARY 29, 1864.

Report of Lieut. Cushing, U. S. Navy.

U. S. S. "MONTICELLO," off WILMINGTON, N. C., March 5, 1864.

SIR: I have the honor to report that I passed the forts at the entrance to this harbor with two boats and 20 men on the night of the 29th of

February, and proceeded up the river to Smithville. My object was to land at that town and capture the commanding general, and to board any vessels that might be found at anchor.

I succeeded in landing directly in front of the hotel, hid my men under the bank, captured some negroes at work in a salt works, and thus gained such information as desired. Then, leaving most of the men to guard the boats, I proceeded with Acting Ensign J. E. Jones and Acting Master's Mate W. L. Howorth and one seaman to General Hébert's headquarters (situated across the street from the barracks, containing about 1000 men). I effected an entry and captured the chief engineer of these defenses, but found that the general had gone to Wilmington the same day. The adjutant-general escaped from the door after severely wounding his hand, but thinking that a mutiny was in progress, took to the woods with a great scarcity of clothing, and neglected to turn out the garrison. My boat was about 50 yards from the Smithville fort, and not so far from the sentinel on the wharf, but I succeeded in bringing my prisoner off so quietly that they did not discover me. The signal lights were made so tardily that I was abreast of Fort Caswell before they knew that boats were in the harbor, and they did not get a shot at us. The papers captured were unimportant. The *Scotia* ran out just before I reached the anchorage, so I did not have the pleasure of calling on her captain. I send Captain Kelly, C. S. Army, to you, deeply regretting that the general was not in when I called.

I am, sir, very respectfully, your obedient servant,

W. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, Hampton Roads.
I brought off the negroes captured.

ABSTRACT LOG OF THE U. S. S. "MONTICELLO," LIEUTENANT CUSHING, U. S. NAVY, COMMANDING, FEBRUARY 28, 1864.

February 28, 1864.—At 4.15 p. m. captain returned on board. At 4.36 got underway. At 4.45 the rebels opened fire upon the ship from the beach on Smith's Island. Returned their fire with 100-pounder and 30-pounder rifles. At extreme elevation our shell all fell short, while several shots of the enemy passed over the ship. Steamed slowly to southward and westward. 6 to 8 p. m.: Steaming to our station. At 6.45 came to anchor. Got gig and first (cutter) prepared for an expedition. At 7.45 first cutter, in charge of Acting Master's Mate W. L. Howorth, was sent in reconnoitering near the shore, watching the channel. 8 to midnight: At 10 the picket boat sent up a rocket, indicating a vessel attempting to run the blockade. Got underway and sighted a steamer and challenged her with two flashes of white light and a red light steady, which was answered by one flash of red-white steady. Not discovering at 11.45, returned to an anchorage. At 11.45 Acting Master's Mate Howorth left the ship in the dingey on picket duty.

February 29.—At 2. a. m. the dingey, in charge of acting master's mate, returned. At 5 got under way and started for the flagship; came to anchor

and scrubbed decks. At 9.20 flagship made signals. At 10 beat to quarters and exercised first and second divisions. At 10.20 beat retreat. Watch employed in spreading boarding netting, cleaning boats, and scraping guns. 4 to 6 p. m: Captain went on board flagship. At 5 p. m. got underway and steamed down to flagship. At 5.30 captain returned on board and we steamed for our station. 6 to 8 p. m.: At 7.15 came to anchor, 4½ fathoms. During the watch got the arms in gig and first cutter. 8 to midnight: At 8.40 p. m. Captain Cushing left the ship in gig, accompanied by Acting Master's Mate W. L. Howorth, and first cutter, in charge of Acting Ensign J. E. Jones, accompanied by (Acting) Second Assistant Engineer Martine, and started for the harbor, with the intention of going to Smithville and capturing the commanding general, Hébert.

March 1.—At 3.25 a. m. gig and first cutter returned, having succeeded in reaching Smithville and landing in safely, capturing 2 contrabands from the salt works and gaining information. We surrounded the general's headquarters and captured Captain Kelly, C. S. Army, chief engineer of the works, the general being absent, having gone to Wilmington the day before. Adjutant-General Hardeman barely escaped capture. Brought the captain and contrabands safely on board. At 5 got underway and steamed offshore to the flagship. At 5.40 came to anchor near the flagship. 8 to meridian: Quarters for inspection 9.30. At 11.30 got underway and ran in toward Fort Caswell with a flag of truce. At 12.30 p. m. first cutter left the ship under a flag of truce, Ensigns Pettit and Jones as flag-of-truce officers. Watch employed spreading boarding nettings.

CONFIDENTIAL LETTER FROM ACTING REAR-ADMIRAL LEE, U. S. NAVY, TO THE ASSISTANT SECRETARY OF THE NAVY, REGARDING GENERAL MATTERS.

(Confidential.) U. S. S. "MINNESOTA," April 4, 1864.

SIR: Yours of the 1st instant came today. Undoubtedly ironclads and some other vessels must be needed here for the approaching campaign.

Should not ironclads for the Gulf be sent either from the Mississippi River or Charleston?

We return to the Army sailors who cannot pass the examination. I thank you heartily for the promise of more vessels for Wilmington when you get seamen now to come promptly from the Army.

You say what a pity that Cushing's undaunted bravery and good luck cannot be put to a useful purpose in a manner to tell upon the enemy. Please explain this. I have always encouraged his dash, and am ever ready to do so. What can he now do? He is urging me to let him cruise off for prizes. He went into Cape Fear River to get prizes. I am rejoiced that he returned with such eclat to the *Monticello*. Pity he did not get a prize then. Well, very well, that the enemy did not get a chance to surprise the *Monticello* by returning in her boats.

He thinks that the fort on Bald Head may be surprised by the blockaders. Will you in any manner, even by a "Go to Ned" (after the fashion of the Attorney and Lord Codrington), justify the attempt? The idea is taking and the thing is possible, though Nelson failed in such an effort. But I

like enterprises, and have always encouraged them. Is this what you hint at?

I have a good idea of, and good feeling for this youngster.

Give me your mind in the matter.

The Richmond ironclads are designed to act between Drewry's Bluff and the city. If you will give the right means for the James River route to Richmond, it can and will be taken. It is now the time to do this big thing. Jo Johnston's report, which General Grant tells me he believes is entirely true, shows the weakness of the rebels. The upper James is the point for naval co-operation, and now is the time.

Respectfully yours,

S. P. LEE,

HON. G. V. FOX,
Assistant Secretary of the Navy.

CONFIDENTIAL LETTER FROM THE ASSISTANT SECRETARY OF THE NAVY TO ACTING REAR-ADMIRAL LEE, U. S. NAVY, REGARDING CUTTING-OUT EXPEDITIONS.

WASHINGTON, April 8, 1864.

ADMIRAL: I have yours of the 4th instant. Porter tells us that not an ironclad he has is fit to be out of the river, and at Charleston they might possibly spare two on an emergency. The duty there is terrible; gales continually, and torpedo boats. Few people dream of the effort required to keep that harbor closed to blockade running. What I meant about Cushing was that it was a pity [that] so much luck and dash had not brought fruits equal to the risk. You notice the Department never finds fault with these exploits. I believe they ought to be encouraged. To be sure, the people will say, when he is captured, "D— fool." The Department will not. I have been reading this new English naval history, and I find their wars abounded in rash coast attacks and cutting-out expeditions of all kinds; they were encouraged and formed a bright page of naval history. You may be very sure that the Department will not find any fault with any dashing expeditions that give reasonable hope of a result injurious to the enemy, even though they fail occasionally.

See how much they make out of John Taylor Woods' exploits—a solemn vote of thanks and everybody cheerful over the capture of three tugs. I am sure I do not blame them for being happy, for I have groaned over the loss constantly, because it was disgraceful to us in each case. Going into the river to destroy a blockade runner about to sail is a most happy idea, and most serious to the enemy, because cotton and despatches would be burned. The first officer that destroys one in this way I think I can promise shall go up several numbers on the list, according to the new law, and if it is Cushing we can add his former exploits and give him thirty numbers up. I think we should all gain credit for such an affair.

G. V. FOX.

REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, Hampton Roads.

UNOFFICIAL LETTER FROM LIEUTENANT CUSHING, U. S. NAVY, TO ACTING REAR-ADMIRAL LEE, U. S. NAVY, PROPOSING TO ENGAGE THE ENEMY'S VESSELS, AND GIVING RESULTS OF OFF-SHORE CRUISING BY THE U. S. S. "MONTICELLO."

U. S. S. "MONTICELLO," BEAUFORT, N. C., May 9, 1864.

SIR: I write unofficially to you to say that, having just learned the particulars of the mortifying affair [this refers to the raid of the Confederate ram *Raleigh* against the blockaders May 6 and 7] off Wilmington, I deem it my duty to leave for the point of danger at once. I feel very badly over the affair, sir, and would have given my life freely to have had the power of showing my high regard for you and the honor of the service by engaging the enemy's vessels. If they are there when I arrive, I shall use the *Monticello* as a ram, and will go over her or to the bottom. If they are inside, I shall send in a written petition to carry the ram by boarding in the harbor. I enclose a copy of application and plan of operations. I trust that the success of this insulting bravado of the enemy will not lead you to distrust us all; I am confident that Captain Braine and myself can sink the ironclad.

My offshore cruising thus far has resulted in one chase, in company with the *Connecticut*, on the 12th of April. Just before black smoke was sighted my main valve stem got bent and it was eighty minutes after we saw it before my cut-off could be detached, giving the Englishman a chance to get to windward of me. I then chased for over 100 miles, but, with full stroke, could only keep up enough steam to go 11 knots. The vessel chased escaped from the *Connecticut*.

On the 22d of April I picked up the English schooner *James Douglass* outside the Gulf Stream, dismasted, and with no one on board. She had 6 feet of water in the hold, and a cargo of cocoanuts and bananas, which I hove overboard. Finding that she was a fine schooner of about 150 tons, and that she was sound and without a leak, I towed her in and will forward her, making a claim for at least 80 per cent salvage.

I think that the blockade runners have given up the direct route and go more to the southward.

There is no doubt but that my vessel can overtake the majority of those vessels, and I trust that you will not cancel my permission to cruise outside after this ram business is settled.

I am, sir, very respectfully,

W. B. CUSHING,

ADMIRAL S. P. LEE,
Hampton Roads, Virginia.

REPORT OF LIEUTENANT CUSHING, U. S. NAVY, SUBMITTING A PLAN FOR THE CAPTURE OF THE C. S. S. "RALEIGH."

WASHINGTON, D. C., May 21, 1864.

SIR: Deeming it possible to capture the rebel ironclad *Raleigh* at Wilmington, N. C., I submit the following plan, respectfully asking that it may receive your favorable consideration:

Selecting a time when the ram is anchored at Smithville, I can, as I have often done, take boats by the forts and up to the anchorage, and, covered by the darkness, approach to within a short distance of the enemy. The *Raleigh's* low, flat decks are very favorable to boarders, while there are but two small hatches communicating with officers' quarters and berth deck. The lookouts can easily be swept away and these hatches guarded, while the main force, rushing through ports and hatch, will secure the unprotected gun deck, which will give us the engine room and magazine hatch.

Objections have been made that after gaining the deck we could no more get at the lower portion of the vessel and the crew than they could get at us. To settle this point, I propose to take in the boats a dozen long-fused shell and a piece of slow match. One shell down each hatch would be likely to bring all hands to terms.

Having captured the ironclad we might bring her out or destroy her, as circumstances dictated.

With my knowledge of the harbor and of the ironclad, I am confident that I would succeed.

I have the honor, sir, to be, very respectfully, your obedient servant,

W. B. CUSHING,
Lieutenant, U. S. Navy, Commanding Monticello.

HON. GIDEON WELLES,
Secretary of the Navy.

LETTER FROM THE SECRETARY OF THE NAVY TO ACTING REAR-ADMIRAL LEE, U. S. NAVY, EXPRESSING APPROVAL OF THE ATTEMPTED DESTRUCTION OF THE C S. RAM "ALBEMARLE," AND APPROVING CUSHING'S PROPOSAL OF MAY 21.

NAVY DEPARTMENT, June 6, 1864.

SIR: The Department approves the gallant attempt to blow up the *Albemarle*. [This refers to an unsuccessful, hazardous attempt by five volunteers from the U. S. S. *Wyalusing* to sink the *Albemarle* at Plymouth, May 26.] Lieutenant William B. Cushing has proposed a scheme with regard to another ironclad which it would be well to encourage, and you will please instruct the senior officer off Wilmington to that effect. Risks to accomplish an important object ought to be undertaken without hesitation, and will never be disapproved by the Department if well arranged and intrusted to good officers.

* * * * * * * * * * *

Very respectfully, etc.,

GIDEON WELLES,
Secretary of Navy.

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, James River.

great credit to his men and officers who received the commendation of the squadron commander and the Navy Department. The Confederates were astounded. Colonel Lamb was furious. Guards and guard-boats were trebled. General Whiting, the Confederate commander of the defenses of Wilmington reported that the enterprising commander of the *Monticello* had passed his forts, captured and carried off his soldiers, eluded picket boats sent to capture him, and aroused the wildest apprehensions. The Confederates were searching for Cushing for days after he had returned to the *Monticello*. Colonel Lamb tells that his soldiers would play jokes at night, pretending that they were Cushing and party, thereby causing great alarm in the fort.

REPORT OF LIEUTENANT CUSHING, U. S. NAVY.

U. S. S. "MONTICELLO," off WILMINGTON, N. C., July 2, 1864.

SIR: In consequence of permission received from you to attempt the destruction of the ironclad ram *Raleigh*, I proceeded to the blockade at that point with the intention of doing so. Judging it prudent to make a thorough reconnoissance, first, to determine her position, I left this ship on the night of the 23d, in the first cutter, with two officers (Acting Ensign J. E. Jones and Acting Master's Mate William Howorth) and 15 men, and started in for the Western Bar. I succeeded in passing the forts, and also the town and batteries of Smithville, and pulled swiftly up the river.

As we neared the Zeek's Island batteries, we narrowly escaped being run down by a steamer, and soon after came near detection from the guard boat, but evading them all we continued our course.

As we came abreast of the Old Brunswick batteries, some 15 miles from the starting point, the moon came out brightly and discovered us to the sentinels on the banks, who hailed at once, and soon commenced firing muskets and raising an alarm by noises and signal lights. We pulled at once for the other shore obliquely, so as to give them to understand that we were going down, but as soon as I found that we were out of the moon's rays we continued our course straight up, thereby baffling the enemy and gaining safety. When within 7 miles from Wilmington, a good place was selected on the shore, the boat hauled up and into a marsh, and the men stowed along the bank.

It was now nearly day, and I had determined to watch the river, and, if possible, to capture some one from whom information could be gained.

Steamers soon began to ply up and down, the flagship of Commodore Lynch, the *Yadkin*, passing within 200 yards. She is a wooden propeller steamer of about 300 tons; no masts, one smokestack, clear deck, English build, with awnings spread fore and aft, and mounting only two guns. Did not seem to have many men. Nine steamers passed in all, three of them being fine, large blockade runners.

Just after dark, as we were preparing to move, two boats rounded the point, and the men, thinking it an attack, behaved in the coolest manner.

Both boats were captured, but proved to contain a fishing party returning to Wilmington.

From them I obtained all the information that I desired, and made them act as my guides in my further exploration of the river.

Three miles below the city I found a row of obstructions, consisting of iron pointed spiles, driven in at an angle, and only to be passed by going into the channel left open, about 200 yards from a heavy battery that is on the left bank. A short distance nearer the city is a ten-gun navy battery and another line of obstructions, consisting of diamond-shaped crates, filled and supported in position by two rows of spiles, the channel in this instance being within 50 yards of the guns. A third row of obstructions and another battery complete the upper defenses of the city. The river is also obstructed by spiles at Old Brunswick, and there is a very heavy earthwork there.

Discovering a creek in the Cypress Swamp, we pulled or rather poled up it for some time, and at length came to a road, which, upon being explored, proved to connect with the main road from Fort Fisher and the sounds to Wilmington. Dividing my party, I left half to hold the cross-road and creek, while I marched the remainder some 2 miles to the main road and stowed away.

About 11.30 a. m. a mounted soldier appeared with a mail bag and seemed much astonished when he was invited to dismount, but as I assured him that I would be responsible for any delay that might take place he kindly consented to shorten his journey. About two hundred letters were captured, and I gained such information as I desired of the fortification and enemy's force. As an expedition was contemplated against Fisher by our army about this time, the information was of much value.

There are 1300 men in the fort, and the unprotected rear that our troops were to storm is commanded by four light batteries. I enclose rebel requisitions and report of provisions on hand.

I now waited for the courier from the other direction, in order that we might get the papers that were issued at 1 p. m. in Wilmington, but just as he hove in sight a blue jacket exposed himself and the fellow took to instant flight. My pursuit on the captured horse was rendered useless from lack of speed, and the fellow escaped after a race of some 2 miles. In the meantime we captured more prisoners and discovered that a store was located about 2 miles distant, and being sadly in need of some grub, Mr. Howorth, dressed in the courier's coat and hat, and mounted upon his horse, proceeded to market.

He returned with milk, chickens, and eggs, having passed everyone, in and out of service, without suspicion, though conversing with many.

At 6 p. m., after destroying a portion of the telegraph wire, we rejoined the party at the creek and proceeded down, reaching the river at dark.

In trying to land our prisoners upon an island a steamer passed so close that we had to jump overboard and hold our heads below the boat to prevent being seen. As we had more prisoners than we could look out for, I determined to put a portion of them in small boats and set them adrift without oars or sails, so that they could not get ashore in time to injure us. This was done, and we proceeded down the river, keeping a bright

EXPEDITION INTO CAPE FEAR RIVER, JUNE 23-26, 1864.

From 8.40 p. m., June 23, to 2.20 p. m., June 26, 1864, Cushing was absent from his ship, the *Monticello,* on one of the most daring expeditions that ever met with success. His purpose, at starting, was the destruction of the Confederate iron-clad ram *Raleigh* near Wilmington. On the night of the 23d of June he left his ship in the first cutter with Acting Ensign John E. Jones and Acting Master's Mate William Howorth, the same officers that had been with him on his previous expedition into Cape Fear River, and fifteen men with rifles, pistols and cutlasses. The party pulled up the river, through Western Bar Channel, narrowly escaped being run down by a steamer, and safely passed forts and batteries. When fifteen miles from the river's mouth, abreast Old Brunswick Battery, the moon came out brightly, the cutter was discovered, shore sentries gave the alarm, fired muskets and showed signal lights. Making a feint of going back, Cushing pulled for the opposite bank out of the moon's rays, and continued up the river. Near daylight the party had reached a point about seven miles below Wilmington and landed, hiding the cutter in a marsh. All the daylight of the 24th was spent in concealment in the willows and bushes. At dark, just as they were preparing to move, two boats were captured containing a party of fishermen returning to Wilmington who were pressed into service as guides. During the night, aided by his prisoners, Cushing explored the harbor, and examined the obstructions four miles below the town. He learned that the *Raleigh* was sunk and the *North Carolina* at anchor close to the town. It was then near daybreak of June 25; the *Monticello* was twenty miles away and Cushing entered a creek in Cypress Swamp and poled up until he came to a road two miles distant from the military road joining Wilmington and Fort Fisher. Cushing took Howorth and seven men and marched the two miles to the military road where cover was found. At 11.30 a. m., the mail messenger from the fort appeared and was captured with two hundred letters and the invaluable official returns giving the strength of the force at Fort Fisher, against which fort an expedition was then contemplated. Cushing waited for the messenger from Wilmington, in order to get the daily newspaper, and just as that worthy hove in sight a blue-jacket exposed himself, and the messenger took to instant flight, pursued by Cushing on the captured horse, but made his escape. Cushing captured

more prisoners, learned of a store some two miles distant, and sent Howorth, wearing the courier's coat and hat and mounted on his horse to secure food. Howorth returned with chickens, milk and eggs, having engaged freely in conversation with many persons. After a delicious dinner the party enjoyed cutting the telegraph wires and at dark returned to the boat. The courier from Wilmington returned to the town and reported seeing Yankee sailors, but he was laughed at and his story was disbelieved. Colonel William Lamb, Commanding Fort Fisher, later made earnest but unsuccessful efforts to have the adjutant at Wilmington punished for culpable negligence in failing to report to him the courier's story, particularly in view of the fact that the courier from the fort had failed to reach Wilmington with the mail at the usual time.

The third and last night in the river had now begun and Cushing prepared to return. Embarking with the prisoners he forced one of them, a pilot, to guide him to the wreck of the *Raleigh*, having set all but two of the prisoners adrift in midstream in small boats without oars or sails. Shortly after leaving the wreck Cushing discovered a small boat near the East Bar with six men, four of them soldiers, and taking them in his boat he cut theirs adrift. Cushing learned from the prisoners that a Confederate guard boat with seventy-five soldiers was in Western Bar entrance and resolved to attempt her capture, and just as he was preparing to attack her three row-boats came from the northward and at the same instant five more appeared from the other side. The cutter was nearly surrounded by eight row-boats and a schooner filled with troops. Cushing instantly made a feint by dashing toward Western Bar; the enemy swallowed the bait and dashed ahead to intercept him but lost sight of him for a time, as the side of his boat toward them was in shadow. Cushing turned suddenly and headed for New Inlet full speed. His coolness communicated itself to his brave sailors; the strokes of the oars kept perfect time; his deep-laden boat by extraordinary pulling gained the passage of the island and before the enemy could prevent shot into the breakers on Caroline Shoal where the enemy dared not follow. Cushing reached the *Cherokee* of the blockading fleet just as day was breaking with twenty-six men (eight prisoners) on board, and at 12.20 p. m., arrived at the *Monticello*, having been absent three nights and two days, and suffered no casualty whatever. Cushing gave

great credit to his men and officers who received the commendation of the squadron commander and the Navy Department. The Confederates were astounded. Colonel Lamb was furious. Guards and guard-boats were trebled. General Whiting, the Confederate commander of the defenses of Wilmington reported that the enterprising commander of the *Monticello* had passed his forts, captured and carried off his soldiers, eluded picket boats sent to capture him, and aroused the wildest apprehensions. The Confederates were searching for Cushing for days after he had returned to the *Monticello*. Colonel Lamb tells that his soldiers would play jokes at night, pretending that they were Cushing and party, thereby causing great alarm in the fort.

REPORT OF LIEUTENANT CUSHING, U. S. NAVY.

U. S. S. "MONTICELLO," off WILMINGTON, N. C., July 2, 1864.

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Both boats were captured, but proved to contain a fishing party returning to Wilmington.

From them I obtained all the information that I desired, and made them act as my guides in my further exploration of the river.

Three miles below the city I found a row of obstructions, consisting of iron pointed spiles, driven in at an angle, and only to be passed by going into the channel left open, about 200 yards from a heavy battery that is on the left bank. A short distance nearer the city is a ten-gun navy battery and another line of obstructions, consisting of diamond-shaped crates, filled and supported in position by two rows of spiles, the channel in this instance being within 50 yards of the guns. A third row of obstructions and another battery complete the upper defenses of the city. The river is also obstructed by spiles at Old Brunswick, and there is a very heavy earthwork there.

Discovering a creek in the Cypress Swamp, we pulled or rather poled up it for some time, and at length came to a road, which, upon being explored, proved to connect with the main road from Fort Fisher and the sounds to Wilmington. Dividing my party, I left half to hold the cross-road and creek, while I marched the remainder some 2 miles to the main road and stowed away.

About 11.30 a. m. a mounted soldier appeared with a mail bag and seemed much astonished when he was invited to dismount, but as I assured him that I would be responsible for any delay that might take place he kindly consented to shorten his journey. About two hundred letters were captured, and I gained such information as I desired of the fortification and enemy's force. As an expedition was contemplated against Fisher by our army about this time, the information was of much value.

There are 1300 men in the fort, and the unprotected rear that our troops were to storm is commanded by four light batteries. I enclose rebel requisitions and report of provisions on hand.

I now waited for the courier from the other direction, in order that we might get the papers that were issued at 1 p. m. in Wilmington, but just as he hove in sight a blue jacket exposed himself and the fellow took to instant flight. My pursuit on the captured horse was rendered useless from lack of speed, and the fellow escaped after a race of some 2 miles. In the meantime we captured more prisoners and discovered that a store was located about 2 miles distant, and being sadly in need of some grub, Mr. Howorth, dressed in the courier's coat and hat, and mounted upon his horse, proceeded to market.

He returned with milk, chickens, and eggs, having passed everyone, in and out of service, without suspicion, though conversing with many.

At 6 p. m., after destroying a portion of the telegraph wire, we rejoined the party at the creek and proceeded down, reaching the river at dark.

In trying to land our prisoners upon an island a steamer passed so close that we had to jump overboard and hold our heads below the boat to prevent being seen. As we had more prisoners than we could look out for, I determined to put a portion of them in small boats and set them adrift without oars or sails, so that they could not get ashore in time to injure us. This was done, and we proceeded down the river, keeping a bright

lookout for vessels in order to burn them, if possible. None was found, but I forced the pilot to take me to where the ram *Raleigh* was said to be wrecked. She is, indeed, destroyed, and nothing now remains of her above water.

The ironclad *North Carolina*, Captain Muse, commanding, is in commission, and at anchor off the city. She is but little relied upon, and would not stand long against a monitor.

Both torpedo boats were destroyed in the great cotton fire some time since. One was very near completion.

As I neared the forts at the East Bar, a boat was detected making its way rapidly to the shore, and captured after a short chase. It contained six persons, four of whom were soldiers. Taking them all into my boat, I cut theirs adrift, but soon found that 26 persons were more than a load. By questions I discovered that at least one guard boat was afloat, containing 75 musketeers, and situated in the narrow passage between Federal Point and Zeek's Island. As I had to pass them I determined to engage the enemy at once, and capture the boat if feasible. The moon was now bright, and as we came near the entrance I saw what we supposed to be one large boat just off the battery, but as we prepared to sail into her, and while about 20 yards distant, three more boats suddenly shot out from that side, and five more from the other, completely blocking up the sole avenue of escape. I immediately put the helm down, but found a large sailboat filled with soldiers to windward and keeping us right in the glimmer of the moon's rays.

In this trying position both officers and men acted with true coolness and bravery. Not the stroke of an oar was out of time; there was no thought of surrender, but we determined to outwit the enemy or fight it out. Suddenly turning the boat's head, we dashed off as if for the Western Bar, and by throwing the dark side of the boat toward them were soon lost to view.

The bait was eagerly seized, and their whole line dashed off at once to intercept us.

Then again turning, by the extraordinary pulling of my sailors, I gained the passage of the island, and before the enemy could prevent, put the boat into the breakers on Caroline Shoals.

The rebels dared not follow, and we were lost to view before the guns of the forts trained on the channel could be brought to bear upon our unexpected position. Deeply loaded as we were, the boat carried us through in fine style, and we reached the *Cherokee* just as day was breaking, and after an absence from the squadron of two days and three nights. I am now posted in regard to the city land and water defenses, and everything that it will interest the Department to know. I beg leave to call your attention, sir, to the fact that Acting Ensign J. E. Jones and Acting Master's Mate William Howorth are the same officers who accompanied me to Smithville some months since, and whom I select because of their uniform enterprise and bravery.

All the men did well, but my coxswain, David Warren, is deserving of a medal of honor for marked bravery in every critical moment. I would also mention Ordinary Seaman John Sullivan and Yeoman William Wright, the latter having volunteered upon every expedition of danger since this

ship has been in commission, in this instance procuring his discharge from the sick list in order to do service.

I am, sir, very respectfully, your obedient servant,

WM. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Commanding North Atlantic Blockading Squadron.

(Endorsement.)

July 6, 1864.

I submit this important reconnoissance to the Department with my hearty approval of the skill and gallantry displayed by Lieutenant W. B. Cushing and the good conduct of the officers and men serving under him.

S. P. LEE,
Actg. Rear-Admiral, Comdg. North Atlantic Blockading Squadron.

ABSTRACT LOG OF THE U. S. S. "MONTICELLO," LIEUT. CUSHING, U. S. NAVY, COMMANDING.

June 20, 1864.—Ship lying to anchor off the shoals. At 8 p. m. got underway and stood in to Fort Caswell. At 9.35 p. m. Captain Cushing, accompanied by Acting Ensign Jones and Acting Master's Mate William Howorth, and 15 men with cutlasses, rifles, and pistols left the ship on an expedition. At 10 the batteries opened fire upon the ship. Stood out and anchored with kedge. At 12, first cutter returned to the ship.

June 23.—At 8.40 p. m. Captain Cushing and Acting Ensign J. E. Jones and Acting Master's Mate W. L. Howorth, with 15 men, went in on a boat expedition, with two day's rations—beef, pork, bread, etc.—with 11 revolvers, 7 pistols, 6 Sharps rifles, and ammunition.

June 26.—At 12.30 p. m. the steamer *Cherokee* arrived from the north side, having in tow our first cutter. At 2.20 p. m. the first cutter returned to the ship, they having succeeded in getting within 4½ miles of Wilmington. Had possession of the main road Saturday. They captured the mail-carrier and mail. Cut the telegraph wire. The prisoners brought to the ship.

LETTER OF COMMENDATION FROM THE SECRETARY OF THE NAVY TO LIEUTENANT CUSHING, U. S. NAVY.

NAVY DEPARTMENT, July 14, 1864.

SIR: The Department has received, through Acting Rear-Admiral Lee, your report of the 2d instant of your reconnoissance of the harbor of Wilmington, N. C.

The boldness exhibited by you on this reconnoissance and the success attending it are most gratifying to the Department. While expressing its thanks to you, the Department does not forget that you are much indebted for your success in this, as on your recent previous reconnoissance, to the brave officers and men who accompanied you and were under your command. Please make known to Acting Ensign J. E. Jones and Acting

Master's Mate W. L. Howorth, whom you commend for enterprise and bravery, the Department's appreciation of their conduct.

To your coxswain, David Warren; William Wright, yoeman, and John Sullivan, seaman, medals of honor will be awarded.

Very respectfully, etc.,

GIDEON WELLES,
Secretary of the Navy.

LIEUTENANT WM. B. CUSHING,
Commanding U. S. S. *Monticello*, off Wilmington.

Admiral Porter wrote:

Cushing's hazardous undertakings were sometimes criticized as useless, but there was more method in them than appeared on the surface, and important information was sometimes obtained, to say nothing of the brilliant example of courage and enterprise which they afforded to others.

Cushing did not always have plain sailing. The master of the British brig *Hound*, examined by him on July 1, 1864, filed complaint against the young commanding officer and the Navy Department administered a stern rebuke, yet, reading between the lines one can see that Cushing was a boy after Gideon Welles' own heart.

REPORT OF LIEUTENANT CUSHING, U. S. NAVY, REGARDING THE BOARDING OF THE BRITISH BRIG "HOUND," JULY 1, 1864.

NAVY DEPARTMENT, WASHINGTON, D. C., September 2, 1864.

SIR: The communication of the Department in reference to the British brig *Hound*, with the enclosures,* has been received, and in reply I would state that at the time the *Monticello* was on her station off Wilmington, N. C., a small brig was reported in sight, and as usual directions were given to board her and overhaul her papers. I did not go on deck, but my executive officer, Acting Ensign Charles A. Pettit, carried the ship within hail and demanded name, destination, cargo, etc. By this time the steamer had forged ahead so as to be out of convenient hail, and two or three musket shots were fired well across the bow to bring her to. All the great guns were loaded with shell, and it was not deemed necessary to fire one. There was nothing dangerous or improper about the musket firing, but merely a notification that we wished to board. The captain of the *Hound*, however, hailed my ship in the most insulting manner, using oaths to emphasize his language, and my boarding officer, Acting Ensign Joseph Hadfield, reported on his return that the language and manner of the Englishman had been in the last degree improper both on deck in the presence of his men and below in the cabin. The brig was not too large for a blockade runner and was in my cruising limits; and I thought proper to overhaul

* Not necessary to publish—complaint of Lord Lyons, British Minister, to State Department.

her again and examine the papers myself, and in order to do so at my leisure I sent a boat to bring the captain and his papers. I have directed my officers to bring captain and papers on board in all cases where a spirit of malice is to be perceived, as I deem it a trick by which a captain might cause the boarding officer to overlook any informalities in the ship's papers.

The captain of the brig came aboard, and I took his papers, telling him I would look them over at my leisure, and he could remain or go aboard his ship, as he pleased. He informed me that he would remain, with my permission. I enquired what his conduct had been, and he answered by lame excuses and final retraction. I told him that he should see the propriety of apologizing to the boarding officer, and he expressed his willingness to do so. I then examined his papers, and finding them correct, told the captain to proceed.

It would have made no difference in my action had the ship been American, or of other nationality, for a national ship must be treated with respect.

I have the honor, sir, to be, very respectfully, your obedient servant,

W. B. CUSHING,
Lieutenant, Commanding U. S. S. *Monticello.*

HON. GIDEON WELLES,
Secretary of the Navy.

LETTER FROM THE SECRETARY OF THE NAVY TO LIEUTENANT CUSHING, U. S. NAVY, DISAPPROVING HIS COURSE IN THE CHASE OF THE BRITISH BRIG "HOUND."

NAVY DEPARTMENT, September 10, 1864.

SIR: I have received your report of the 2d instant in explanation of your proceedings on the 1st of July last at sea, in the case of the British brig *Hound*, against which complaints have been justly made.

Your own statement and that of the master of the brig concur in the following particulars:

That, in the exercise of the belligerent right of search, you fired musket shots across the bow of the *Hound* to bring her to; that she was boarded and her papers examined and found correct by the boarding officer, and the vessel ascertained to be on a legitimate voyage; that the vessel was permitted to proceed on her course, was subsequently overhauled again and boarded, but the captain, with his papers, was brought on board the *Monticello*, unlawfully and unnecessarily detained, and then permitted to resume his voyage.

The Department fails to find in your explanation any excuse for your disregard of international law and courtesy, but regrets to perceive in your conduct a disregard of both, and a flagrant violation of its oft-repeated instructions.

The customary notice of your desire to speak the *Hound* by showing your colors and firing a blank cartridge was not, in the first instance, observed. The use of musketry was a departure from the recognized practice. After the right of search had been exercised, no ground for detention or seizure discovered, and the vessel allowed to proceed, she was again brought to and unwarrantable and unjustifiable measures adopted.

What was your object in again overhauling the brig? You state that your boarding officer reported on his return from the first examination that the language and manner of the master of the brig had been in the last degree improper, both on deck in the presence of his men and below in the cabin, and that you thought proper to overhaul her again and examine the papers yourself, and in order to do so at your leisure, you brought the captain and his papers on board the *Monticello,* which is your custom where a spirit of malice is perceived, which is a trick that might cause a boarding officer to overlook any informalities in the ship' papers.

If on hearing the report of the boarding officer there had been anything in it to induce you to believe that the vessel was not all right, it would not have been improper in you to overhaul the vessel for the purpose of making a personal examination of the papers or the vessel itself. But there was impropriety in taking the master out of his ship, carrying him on board your own, and there detaining him some hours, with a view to examining the papers at your leisure. Something more than the verification of the vessel's papers is apparent in your procedure; a disposition was exhibited, if the object was not actually accomplished, to punish the master of the brig for an offense against courtesy, and a manifestation of authority, assumed rather than rightful, over him and the vessel in his charge. In adopting this course of correcting a discourtesy on the part of the master of the brig, you inflicted injury on the owners of the vessel in unnecessarily detaining her, and abused the belligerent right of search.

Were this the first time the Department has had to remind you of the necessity of rigidly observing the customary rules on the high seas, it might have been induced to express in milder terms its disapprobation of your proceedings in the case of the *Hound.* I enclose herewith a copy of the circular instructions of the Department to our cruisers, issued August 18, 1862, and trust that you will give them attention, considering well their injunction to "exercise great forbearance with great firmness, and manifest to the world that it is the intention of our Government, while asserting and maintaining our own rights, to respect and scrupulously regard the rights of others."

The Department is not upholding the master of the brig in his discourteous and offensive manner to the boarding officer of the *Monticello,* but cannot allow his conduct to shield you against an earnest expression of its disapprobation.

In conclusion, I must enjoin upon you to be more cautious in future. Such proceedings repeated cannot fail to bring upon you the serious displeasure of your Government and result to your regret and injury. While the Department is always ready to accord to officers of the service, as it has in several instances in your own case, due credit for valor and efficiency in the discharge of duty, it is not the less so to disapprove and punish when disapprobation and punishment are deserved.

Very respectfully, etc.,

GIDEON WELLES,
Secretary of the Navy.

LIEUTENANT WM. B. CUSHING, U. S. Navy, New York.

(Confidential.)

FLAGSHIP NORTH ATLANTIC BLOCKADING SQUADRON, HAMPTON ROADS,
Virginia, July 9, 1864.

SIR: Lieutenant Cushing arrived here on the 5th instant, bringing his report of his reconnoissance near Wilmington. I suggested his making an attempt to destroy the rebel ram *Albemarle* at Plymouth. He at first proposed an attack on the ram with our gunboats at Plymouth, or a boat expedition, led by himself, with 80 men.

I concur in Captain Smith's opinion that it would be inexpedient to fight the ram with our long double-enders in that narrow river. I proposed to Lieutenant Cushing a torpedo attack, either by means of the india-rubber boat heretofore applied for, which could be transported across the swamp opposite Plymouth, or a light-draft, rifle-proof, swift steam barge, fitted with a torpedo.

In the meantime delay ensued from the *Monticello* getting ashore in the Elizabeth River. The enclosed letter from Lieutenant Cushing contains his mature views on the subject. The *Monticello* will return to the blockade as soon as Lieutenant Kempff arrives, who is hourly expected, and Lieutenant Cushing, who desires to superintend the fitting of the boats he may have, is instructed to report to the Department and deliver this communication. I have enjoined secrecy and discretion upon him. He is entirely willing to make an attempt to destroy the ram, and I have great confidence in his gallantry.

I have the honor to be, sir, very respectfully, yours,
S. P. LEE,
Actg. Rear-Admiral, Comdg. North Atlantic Blockading Squadron.

HON. GIDEON WELLES,
Secretary of the Navy, Washington, D. C.

(Subenclosure.)

(Confidential.)

U. S. S. "MONTICELLO," HAMPTON ROADS, Virginia, July 9, 1864.

SIR: Deeming the capture or destruction of the rebel ram *Albemarle* feasible, I beg leave to state that I am acquainted with the waters held by her, and am willing to undertake the task.

If furnished with three low-pressure tugs, one or more fitted with torpedoes, and all armed with light howitzers, it might be effected, or, if rubber boats were on hand to transport across the swamp to a point immediately abreast of Plymouth. If detailed for this work, I would like to superintend the outfit of the boats, and would be glad to see Lieutenant Kempff, of the *Connecticut*, in charge of the *Monticello* during my absence.

I am, sir, very respectfully, your obedient servant,
W. B. CUSHING,
Lieutenant, Commanding.

ACTING REAR-ADMIRAL S. P. LEE,
Comdg. North Atlantic Blockading Squadron, Hampton Roads.

Cushing's plan to fit out torpedo boats to destroy the *Albemarle* was heartily approved by the Navy Department, and the work of preparation was done at the New York Navy Yard. Assistant Engineer George W. Melville, later a rear-admiral, gave Cushing great assistance, doing much of the blacksmith work with his own hands and with his usual energy and skill. Commander Charles Stewart Boggs also aided Cushing in this preparation of his torpedo boats.

NAVY DEPARTMENT, July 28, 1864.

SIR: Proceed to New York and report to Rear-Admiral Gregory, who will assist you in the purchase of a suitable tug and india-rubber boat.

Very respectfully,

GIDEON WELLES,
Secretary of the Navy.

LIEUTENANT W. B. CUSHING, U. S. NAVY.
Commanding U. S. S. *Monticello*, Present.

(Telegram.)

NAVY DEPARTMENT, August 7, 1864.

Fit out as early as practicable two of the picket boats for Lieutenant W. B. Cushing.

GIDEON WELLES,
Secretary of the Navy.

REAR-ADMIRAL F. H. GREGORY, U. S. Navy, New York.

U. S. HOTEL, NEW YORK, September 9, 1864.

SIR: Can I send the picket boats through the canal to Chesapeake Bay in charge of their officers, and go myself by the usual route and meet them there? The torpedo is all that detains them now, and that will soon be completed.

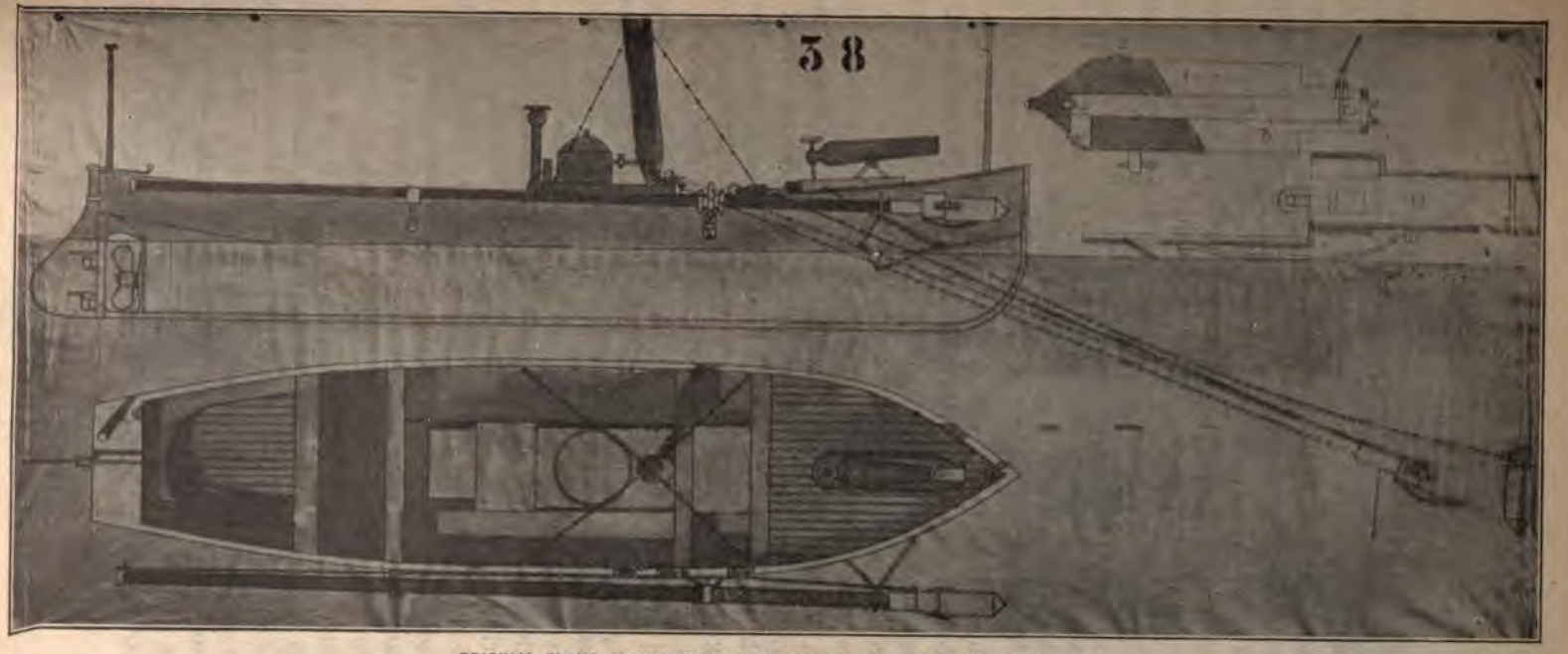
Very respectfully,

W. B. CUSHING,
Lieutenant, U. S. Navy.

HON. G. V. FOX,
Assistant Secretary of the Navy, Washington, D. C.

EXPEDITION FOR THE DESTRUCTION OF THE C. S. RAM "ALBEMARLE," AT PLYMOUTH, N. C., OCTOBER 27-28, 1864, UNDER THE COMMAND OF LIEUTENANT CUSHING, U. S. NAVY.

The two picket-boats, each about thirty feet in length, with torpedoes and spars made the trip from New York by inland route. Picket Boat No. 1 and Cushing arrived safely at Hampton Roads, October, 10, 1864, after a trying and dangerous trip. Picket



ORIGINAL PLANS OF CUSHING'S TORPEDO LAUNCH, BOOM AND TORPEDO.

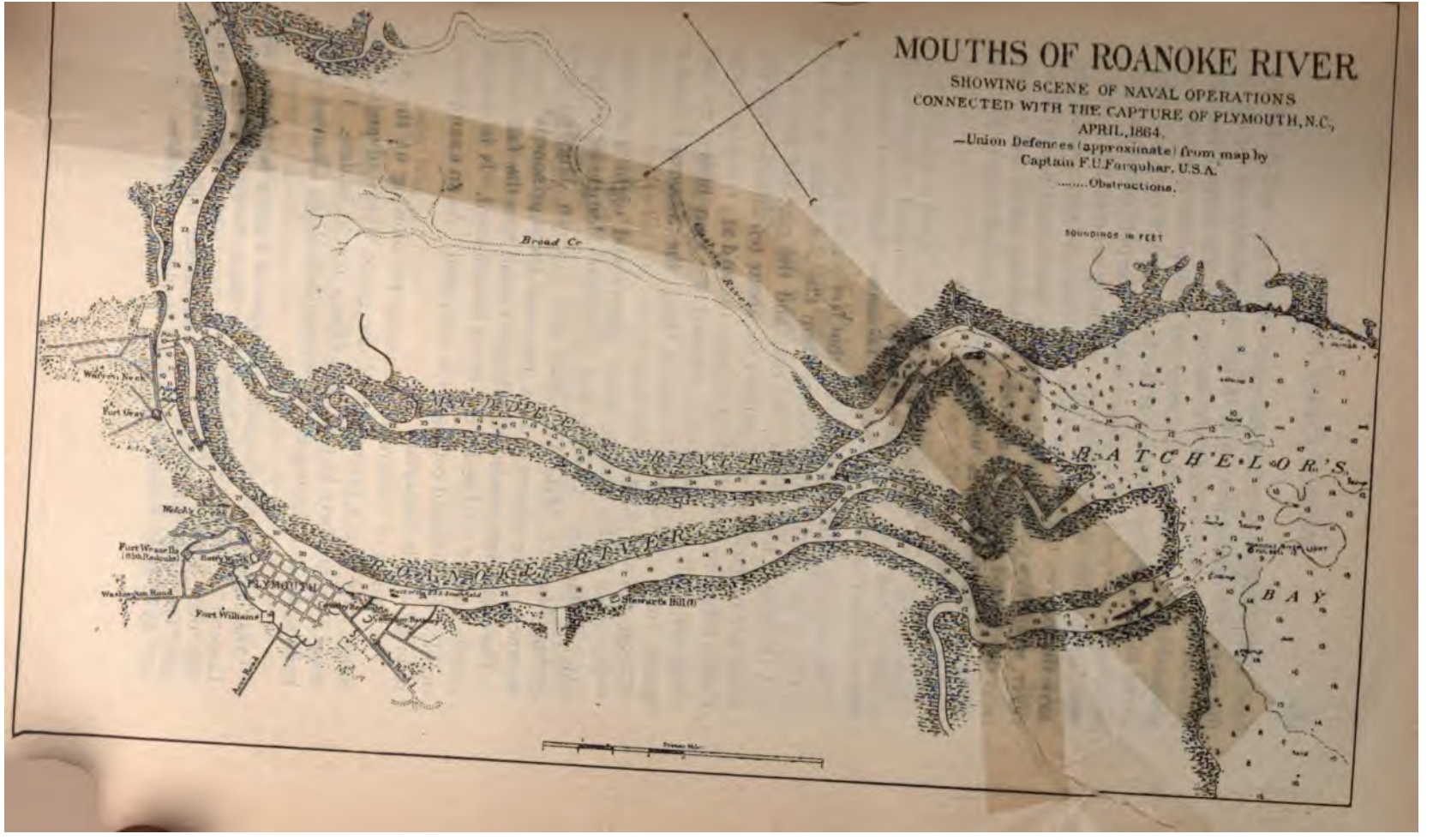
Boat No. 2, under a volunteer officer was captured by Confederates in Wicomico Bay, October 8. Rear-Admiral Porter who assumed command of the North Atlantic Blockading Squadron, October 12, 1864, sent Cushing, weak and worn with exposure and loss of sleep on a three day's fruitless search for the missing Picket Boat No. 2. Finally Porter sent Cushing on his way through the Dismal Swamp to the sounds of North Carolina, where he arrived and reported to the senior officer, Commander W. H. Macomb. Porter's instructions to Macomb read in part:

> I have directed Lieutenant Cushing to go down in a steam launch and if possible destroy this ram with torpedoes. I have no great confidence in his success, but you will afford him all the assistance in your power, and keep boats ready to pick him up in case of failure.

After two days of preparation Cushing attempted to move up the Roanoke River to Plymouth on the night of October 26, but got aground and returned to the *Otsego* in the sound, and arranged to attack the ram on the night of the 27th.

The ram *Albemarle* had engaged the wooden gun-boats on April, 19, 1864, and driven the Union vessels from Roanoke River, sunk the *Southfield* and made certain the capture of Plymouth, which surrendered April 20. On May 5, 1864, she had engaged the squadron in the western part of Albemarle Sound, badly damaged the *Sassacus*, and withdrawn to Plymouth. She lay in October, 1864, below the custom house wharf in Plymouth, stern upstream, moored to the bank and wharf, with a boom of cypress logs around her to prevent her injury by torpedoes, for the Confederates were well informed of Cushing's intentions. Plymouth is on the right bank of the river eight miles from its mouth. The river in autumn stages is low and slow, 150 to 200 yards wide, lined on both banks with swamp land timber. One mile below Plymouth lay the wreck of the *Southfield*, commanded by a battery abreast her. On the wreck were four Confederate pickets.

The night of October 27, 1864, was dark and rainy in the sounds, with light airs and breezes, temperature of air about 66°, water 55°. At 11.28 p. m., Cushing in his launch with fifteen souls aboard left the *Shamrock*, towing that ship's second cutter with Acting Gunner William Peterkin, Acting Master's Mate Wilson D. Burlingame, and ten men. Cushing steamed up the river past the Southfield and battery abreast without being seen, cast off the cutter with orders to capture the pickets on the *South-*


MOUTHS OF ROANOKE RIVER
SHOWING SCENE OF NAVAL OPERATIONS
CONNECTED WITH THE CAPTURE OF PLYMOUTH, N.C.,
APRIL, 1864.
—Union Defences (approximate) from map by
Captain F.U. Farquhar, U.S.A.
.....Obstructions.
SOUNDINGS IN FEET
Broad Cr
ROANOKE RIVER
ROANOKE RIVER
BATCHELOR'S
BAY
Fort Gray
Fort Williams
PLYMOUTH
Stewart's Bill (I)

field, and proceeded to attack the ram. When seen and hailed by the sentries, Cushing was not disturbed but maneuvered for a fair position under the enemy's continuous fire, discharged his 12-pounder howitzer at the enemy, sang out "Leave the ram! we are going to blow you up," rushed at the boom, passed over it, coolly detached his torpedo and exploded it under the port quarter of the ram, sinking her at her moorings. Cushing ordered his men to save themselves, removed his shoes and coat, and sprang into the river, swam to a point below the town, lay in a swamp a part of the next day, found a skiff in a creek, reached the sound and rowed toward the *Valley City*, whose log for October 28 reports his arrival as follows:

> At 10.15 p. m. heard some one hailing for a boat. Went to quarters, and slipped the cable, sent an armed boat away in charge of Acting Ensign Milton Webster, which brought on board Lieutenant William B. Cushing.

The log of the *Shamrock* records that her second cutter returned at 6.45 a. m., with four prisoners from the *Southfield*, reporting that the launch had attacked the ram, and the ram had kept up a heavy fire of musketry and artillery for about ten minutes, that the *Valley City* blew her whistle at 11.00 p. m., and at 11.30 p. m. came alongside with Cushing, who reported the ram blown up and launch sunk. All hands "cheered ship," the *Shamrock* fired a IX-inch gun and signaled the fleet.

The crew in the launch, seven officers and eight men, were mainly volunteers. Cushing and a fireman, Houghton, escaped. Acting Master's Mate Woodman and Fireman Higgins were drowned. Five officers and six men were taken prisoners.[4]

The immediate result of Cushing's exploit was the fall of Plymouth, but the total result can never be measured. It is immeasurable. For intrepid courage it is unequaled. As an example and inspiration it is immortal.

The thanks of Congress to Cushing for blowing up the *Albemarle* gave him a promotion of one grade which advanced him about fifty numbers in rank, and fifteen months in date. For the gallant deed of sinking the *Merrimac* in Santiago Channel, Lieu-

[4] The accounts of the marvelous heroism of Cushing in "Battles and Leaders;" "Blockade and Cruisers," by Soley; Harper's Magazine for July, 1874; Naval War Records, Vol. 10 *et al.*; "Three Wisconsin Cushings," by Theron Wilber Haight; and "Commander William Barker Cushing," by E. M. H. Edwards, are spirited, thrilling and felicitous.

tenant Hobson was promoted four grades, and about thirteen years in date. For burning the *Philadelphia* in Tripoli Harbor, Decatur was promoted two grades and about ten years in date.

Cushing's little launch was recaptured by Commander Macomb, repaired and used as an instruction boat for cadets at the U. S. Naval Academy for many years.

The *Albemarle* was raised and taken to Norfolk where the metal was stripped from her and her hull sold. She was built by Gilbert Elliott, a youth one year younger than Cushing. Her keel was laid in a cornfield at Edward's Ferry on Roanoke River, and she was completed just in time to give battle to the Union gun-boats, April 19, 1864. She was a twin screw ironclad ram, 158 feet long, 35 feet wide, 4-inch armor, 9 feet draft, and carried at each end a 6.4-inch Brooke rifle which fired from three hinged ports. The bow gun could fire ahead or on either side. The stern gun could fire astern or on either side. Owing to the bar at the mouth of Roanoke River she could not pass into Albemarle Sound except at time of high water in the river which occurred during the spring months.

(Telegram.)

FORTRESS MONROE, VA., November 1, 1864. (Received 1.25 p. m.)

I sent Lieutenant Cushing on the 17th of October, with picket launch No. 1, to blow up the ram *Albemarle*. He returned to-day and reports to me he blew up the *Albemarle* on the morning of the 28th. The destruction was complete. Picket launch No. 1 was destroyed by the enemy's shot and sunk; one man escaped with Lieutenant Cushing; the others captured. I promised Cushing promotion to another grade if he succeeded. Hope the Department will honor the promise if the report is corroborated. Commander Macomb writes me: "From circumstances which have since occurred, I am able to inform you that the ram is sunk."

DAVID D. PORTER,
Rear-Admiral.

HON. GIDEON WELLES,

REPORT OF LIEUTENANT CUSHING, U. S. NAVY, COMMANDING EXPEDITION.

ALBEMARLE SOUND, NORTH CAROLINA, October 30, 1864.

SIR: I have the honor to report that the rebel ironclad *Albemarle* is at the bottom of the Roanoke River. On the night of the 27th, having prepared my steam launch, I proceeded up toward Plymouth with 13 officers and men, partly volunteers from the squadron.

The distance from the mouth of the river to the ram was about 8 miles, the steam averaging in width some 200 yards, and lined with the enemy's pickets. A mile below the town was the wreck of the *Southfield*, sur-

rounded by some schooners, and it was understood that a gun was mounted there to command the bend. I, therefore, took one of the *Shamrock's* cutters in tow, with orders to cast off and board at that point if we were hailed. Our boat succeeded in passing the pickets, and even the *Southfield*, within 20 yards, without discovery, and we were not hailed until by the lookouts on the ram. The cutter was then cast off and ordered below, while we made for our enemy under a full head of steam.

The rebels sprung their rattle, rang the bell, and commenced firing, at the same time repeating their hail and seeming much confused.

The light of a fire ashore showed me the ironclad made fast to the wharf, with a pen of logs around about 30 feet from her side.

Passing her closely, we made a complete circle so as to strike her fairly, and went into her bows on. By this time the enemy's fire was very severe, but a dose of canister at short range served to moderate their zeal and disturb their aim. Paymaster Swan, of the *Otsego*, was wounded near me, but how many more I know not. Three bullets struck my clothing, and the air seemed full of them.

In a moment we had struck the logs, just abreast of the quarter port, breasting them in some feet, and our bows resting on them. The torpedo boom was then lowered and by a vigorous pull I succeeded in diving the torpedo under the overhang and exploding it at the same time that the *Albemarle's* gun was fired. A shot seemed to go crashing through my boat, and a dense mass of water rushed in from the torpedo, filling the launch and completely disabling her.

The enemy then continued his fire at 15 feet range, and demanded our surrender, which I twice refused, ordering the men to save themselves, and removing my own coat and shoes. Springing into the river, I swam, with others, into the middle of the stream, the rebels failing to hit us.

The most of our party were captured, some were drowned, and only one escaped besides myself, and he in another direction. Acting Master's Mate Woodman, of the *Commodore Hull*, I met in the water half a mile below the town, and assisted him as best I could, but failed to get him ashore.

Completely exhausted, I managed to reach the shore, but was too weak to crawl out of the water until just at daylight, when I managed to creep into the swamp, close to the fort. While hiding a few feet from the path, two of the *Albemarle's* officers passed, and I judged from their conversation that the ship was destroyed.

Some hours' traveling in the swamp served to bring me out well below the town, when I sent a negro in to gain information and found that the ram was truly sunk.

Proceeding through another swamp, I came to a creek and captured a skiff, belonging to a picket of the enemy, and with this, by 11 o'clock the next night, had made my way out to the *Valley City*.

Acting Master's Mate William L. Howorth, of the *Monticello*, showed, as usual, conspicuous bravery. He is the same officer who has been with me twice in Wilmington harbor. I trust he may be promoted, when exchanged, as well as Acting Third Assistant Engineer Stotesbury, who, being for the first time under fire, handled his engine promptly and with

coolness. All the officers and men behaved in the most gallant manner. I will furnish their names to the Department as soon as they can be procured.

The cutter of the *Shamrock* boarded the *Southfield*, but found no gun. Four prisoners were taken there.

The ram is now completely submerged, and the enemy have sunk three schooners in the river to obstruct the passage of our ships.

I desire to call the attention of the admiral and Department to the spirit manifested by the sailors on the ships in these sounds. But few men were wanted, but all hands were eager to go into the action, many offering their chosen shipmates a month's pay to resign in their favor.

I am, sir, very respectfully, your obedient servant,

W. B. CUSHING,
Lieutenant, U. S. Navy.

REAR-ADMIRAL D. D. PORTER,
Commanding North Atlantic Squadron.

The name of the man who escaped is William Hoftman, seaman, on the *Chicopee*. He did his duty well, and deserves a medal or honor.

Respectfully,

W. B. CUSHING,
U. S. Navy.

REPORT OF ACTING ENSIGN GAY, U. S. NAVY.

PORTSMOUTH, N. H., March 7, 1865.

SIR: In obedience to your order I have returned to my home, and submit the following report of my capture: On the 26th of October, 1864, Lieutenant Cushing came alongside of the U. S. S. *Otsego*, then on picket duty near the mouth of the Roanoke River, with picket boat No. 1, to proceed up to Plymouth to endeavor to destroy the rebel ram *Albemarle*. Wishing to act a part in the expedition, I immediately offered my services, which were accepted. Having made all necessary preparations we left the U. S. S. *Otsego* at 11 p. m., having the U. S. S. *Shamrock's* cutter in tow, with 2 officers and 10 men. We then proceeded up the river. Having passed the pickets on the *Southfield* and Fort Race without being discovered, we came within hailing distance of the ram. The cutter was then cast off and ordered to proceed back and capture the pickets on the *Southfield*. Seeing a light ahead, which we took to be on board the *Albemarle*, we approached carefully under full speed, but on coming parallel with the light [it] showed us the ram astern of us. On turning around we were hailed from the ram. We made no answer. We were hailed again, making no answer, but still getting in a fair position.

The next call was not so pleasant, for we were discovered, and the grape and canister began to play on our small craft in rapid succession, which was returned by our 12-pounder. At the same time Lieutenant Cushing sang out with several others, "Leave the ram, or I'll blow you to pieces!" Having backed our boat sufficiently to get headway enough on

her to jump the log pen which encircled the ram, we succeeded in jumping the logs and lowering the torpedo boom, and by a vigorous pull Lieutenant Cushing succeeded in exploding the torpedo under the port bow of the ram. Everything now was in the greatest of excitement on account of the heavy musketry we were receiving from the ram. Having backed our boat off from the *Albemarle*, we came in contact with the logs which were encircled around her. Finding it impossible to extricate our boat, and being twice ordered to surrender, Lieutenant Cushing gave the order not to surrender, at the same time sang out, "Men, save yourselves," and immediately sprang overboard, several others following the example. I had not proceeded far from the boat when I fell in with Acting Ensign William L. Howorth on a log, unable to proceed farther without assistance. Having a life preserver with me, I gave it to him and returned to the boat to procure another, not knowing how far I might have to swim, and at the same time I destroyed two boxes of ammunition and several carbines. I had not gone far the second time when I found myself chilled, and after a severe struggle I regained the circle of logs, where I found several of the crew, with a boat from the ram in charge of Lieutenant Roberts. We were all taken on shore and marched to the prison, where we remained until our gunboats made their approach up the river. We were then marched to Tarboro, N. C., a distance of 60 miles, [at] which place we arrived on the 2d of November, being very tired and feet badly swollen. On the 3d we were sent to Salisbury, where we arrived on the 5th. After marching about 2 miles we arrived at the stockade, where we were enclosed with some 10,000 prisoners. Here we suffered immensely for the want of shelter from the inclemency of the weather and also for provisions, as our fare was very poor, being one-half pint of meal per day, which was very inconvenient on account of having no cooking utensils. On the 13th we were sent to Danville, where [we] arrived on the 14th. Here we were placed in a brick building with about 500 army officers. This place we found to be more comfortable, as we were sheltered from the weather, but still not having a blanket or cover of any kind, which made it very severe for us. Our ration here was a piece of corn bread, 4 inches long, 2 wide, and 1½ thick; this consisted of our day's ration. On the 11th of December we were sent to Richmond, Va., and confined in Libby Prison. There we found the treatment much the same as at Danville. On the 21st of February, 1865, we were paroled, and arrived at Cox's Landing the same afternoon and repaired on board of the flag-of-truce steamer *New York*, where we received a bountiful supply [of] edibles. Hoping this will meet with your approbation,

I remain, your obedient servant,

THOMAS S. GAY,
Acting Ensign, U. S. Navy.

Hon. GIDEON WELLES,
Secretary of the Navy, Washington, D. C.

COPY OF LETTER FOUND IN THE POST-OFFICE AT PLYMOUTH, N. C., NOVEMBER 1, 1864.

U. S. S. "ALBEMARLE," PLYMOUTH, N. C., October 29, 1864.

ESTEEMED FRIEND: I received your kind epistle of the 20th instant, finding me lingering under a severe attack of the fever. I am now up and about again, nearly as well as ever. They are sending out expeditions every now and then. We captured a Yankee yawl boat. It is supposed we killed nearly all of her crew, consisting of about eight men. But the most awful thing of all (perhaps you will hear of it before this reaches you) is that a Yankee torpedo boat steamed up the river Thursday night, and about 3 o'clock Friday morning ran into the *Albemarle*. The torpedo bursting, blew a great hole in her some 6 feet long, sinking her almost instantly. She is now lying at the bottom of the Roanoke River. The crew lost everything they had, bed clothing and everything. Some lost their hats and shoes, and some even came out in their shirts and drawers, barefooted. We are in an awful condition. I believe they are going to hold the place to the bitter end. Captain Warley says he intends to fight as long as there is a man left (this is all gas). I never did witness such an uproar before in my life. Troops were hurrying to and fro, expecting every moment to meet in battle dread. But, fortunately, there has been no attack, though there is no telling how soon we may see a man-of-war steaming up the river, belching forth fury in her mad career, carrying in her front the token of devastation and ruin. We are going to take command of one of the forts on the river.

* * * * * * * * * * *

Direct your letter to Plymouth, N. C., care of Captain Warley.

I remain, as ever, your sincere friend,

E. K. L.

GENERAL ORDER OF REAR-ADMIRAL PORTER, U. S. NAVY, ANNOUNCING THE DESTRUCTION OF THE RAM.

GENERAL ORDERS,

No. 34.

NORTH ATLANTIC SQUADRON, FLAGSHIP "MALVERN," November 5, 1864.

Nothing stimulates the energy and zeal of officers and men more than a proper appreciation of their services. It is always my desire to give full credit to all officers and men under my command who may distinguish themselves and reflect credit upon the naval service. It is right that the creditable work of an officer should be made known to those serving in the same squadron.

It affords me pleasure to inform the officers and men of the squadron under my command that the rebel ram *Albemarle*, which has for so long a time kept a large force of vessels employed to watch her, has been destroyed by Lieutenant William B. Cushing, who, in this hazardous enterprise, has displayed a heroic enterprise seldom equaled and never excelled. In the face of a watchful enemy, and under a heavy fire of musketry and great guns, he went right into the ram *Albemarle* and blew her up, his own boat being destroyed by one of the enemy's shot. To say

nothing of the moral effect of this gallant affair, the loss of this vessel to the rebels cannot be estimated. It leaves open to us all the Albemarle Sound and tributaries, and gives us a number of vessels for employment elsewhere (hitherto kept to watch the ram), which has been a great source of annoyance to the vessels in the sound. The gallant exploits of Lieutenant Cushing previous to this affair will form a bright page in the history of the war, but they have all been eclipsed by the destruction of the *Albemarle*. The spirit evinced by this officer is what I wish to see pervading this squadron. He has shown an absolute disregard of death or danger, and will no doubt be suitably rewarded by the Government, which reward he well deserves. Opportunities will be offered to all those who have the energy and skill to undertake like enterprises; and 20 volunteers are wanted at this moment to perform a like service. The chances are death, capture, glory, and promotion.

DAVID D. PORTER,
Rear-Admiral, Commanding North Atlantic Squadron.

To be read to the officers and crew assembled on the quarter-deck of each vessel in this squadron.

NOTE.—In response to General Orders, No. 34, requesting twenty volunteers for extra hazardous duty, 77 officers, 149 enlisted men, and the entire ship's company of the U. S. S. *Tuscarora* volunteered their services.—COMPILERS.

LETTER OF COMMENDATION FROM THE SECRETARY OF THE NAVY TO LIEUTENANT CUSHING, U. S. NAVY.

NAVY DEPARTMENT, November 9, 1864.

SIR: Your report of October 30 has been received, announcing the destruction of the rebel ironclad steamer *Albemarle* on the night of the 27th ultimo at Plymouth, N. C.

When last summer the Department selected you for this important and perilous undertaking, and sent you to Rear-Admiral Gregory at New York to make the necessary preparations, it left the details with you to perfect. To you and your brave comrades, therefore, belongs the exclusive credit which attaches to this daring achievement. The destruction of so formidable a vessel, which had resisted the continued attack of a number of our steamers, is an important event, touching our future naval and military operations. The judgment, as well as the daring courage displayed, would do honor to any officer, and redounds to the credit of one 21 years of age.

On four previous occasions the Department has had the gratification of expressing its approbation of your conduct in the face of the enemy, and in each instance there was manifested by you the same heroic daring and innate love of perilous adventure—a mind determined to succeed and not to be deterred by any apprehensions of defeat.

The Department has presented your name to the President for a vote of thanks, that you may be promoted one grade, and your comrades also shall receive recognition.

It gives me pleasure to recall the assurance you gave me at the commencement of your active professional career that you would prove yourself worthy of the confidence reposed in you and of the service to which you were appointed. I trust you may be preserved through further trials, and it is for yourself to determine whether, after entering upon so auspicious a career, you shall by careful study and self-discipline be prepared for a wider sphere of usefulness on the call of your country

Very respectfully,

GIDEON WELLES,
Secretary of the Navy.

LIEUTENANT W. B. CUSHING, U. S. Navy, Washington, D. C.

LETTER OF THE PRESIDENT OF THE UNITED STATES TO CONGRESS, RECOMMENDING A VOTE OF THANKS TO LIEUTENANT CUSHING, U. S. NAVY.

TO THE SENATE AND HOUSE OF REPRESENTATIVES: In conformity to the law of the 16th July, 1862, I most cordially recommend that Lieutenant William B. Cushing, U. S. Navy, receive a vote of thanks from Congress for his important, gallant, and perilous achievement in destroying the rebel ironclad steamer *Albemarle* on the night of the 27th October, 1864, at Plymouth, N. C. The destruction of so formidable a vessel, which had resisted the continued attacks of a number of our vessels on former occasions, is an important event touching our future naval and military operations, and would reflect honor on any officer, and redounds to the credit of this young officer and the few brave comrades who assisted in this successful and daring undertaking.

This recommendation is specially made in order to comply with the requirements of the ninth section of the aforesaid act, which is in the following words, viz:

"That any line officer of the Navy or Marine Corps may be advanced one grade, if, upon recommendation of the President by name, he received the thanks of Congress for highly distinguished conduct in conflict with the enemy, or for extraordinary heroism in the line of his profession."

ABRAHAM LINCOLN.

WASHINGTON CITY, December 15, 1864.

RESOLUTION TENDERING THE THANKS OF CONGRESS TO LIEUTENANT CUSHING AND TO THE OFFICERS AND MEN WHO ASSISTED HIM IN THE DESTRUCTION OF THE C. S. RAM "ALBEMARLE."

That the thanks of Congress are due, and are hereby tendered, to Lieutenant William B. Cushing, of the United States Navy, and to the officers and men under his command, for the skill and gallantry displayed by them in the destruction of the rebel ironclad steamer *Albemarle* at Plymouth, North Carolina, on the night of the twenty-seventh of October, eighteen hundred and sixty-four.

Approved December 20, 1864.

After the destruction of the *Albemarle*, Cushing was placed in command of Rear-Admiral Porter's flag steamer *Malvern*, and led the squadron to its attacks on Fort Fisher. There Cushing's active services were so urgently needed that he was again placed in command of his staunch vessel the *Monticello* and rendered excellent service. The following contemporaneous newspaper account is descriptive of the work done by Cushing in sounding for anchorage of the Union vessels in the first attack on Fort Fisher. Cushing considered this his most hazardous experience and has stated that he was under fire for six hours.

(Newspaper extract—*Philadelphia Inquirer.*)

At one o'clock a small boat was launched from the *Malvern*, containing Lieutenant William B. Cushing, he who sunk the *Albemarle*, Master's Mate Horton, of the *Malvern*, and thirteen seamen. The little boat carried the blue and white pennant of a commanding officer, to which Lieutenant Cushing is entitled. The frail craft headed toward the fort, and the thirteenth stood in the bow, casting a lead, and announcing the soundings. Master's Mate Horton sat in the stern noting the depths, and Lieutenant Cushing directed the course to be rowed and sounded. For ten minutes the rebels seemed paralyzed with this audacious piece of coast surveying, and then they trained their guns on the boat and fired, the first shot striking the water not more than fifty feet from the boat.

Not the least disturbed was Cushing or his men; the sailors rowed steadily, the lead was thrown, the soundings noted, as if shot and shell were not dropping all around them, and at times splashing them with water which they cast high in the air.

Steadily forward sped the little boat. Under the very muzzles of Fisher's guns were the soundings taken. When a biscuit might be tossed from the boat to the beach, Lieutenant Cushing signalled his men to cease rowing, and he stood up in the stern of his frail craft and took a cool and deliberate survey of the fort. There he stood, a glittering target for the rebel gunners, for he wore every stripe of lace to which his rank entitles him. The rebel gunners deemed him incorrigible or respected his bravery; but what is more likely, they saw more Yankee audacity in the distance.

At the attack by assault on the fort on January 15, 1865, and after the repulse of the naval party, Cushing organized a field hospital and also relieved the army forces in the trenches, thereby releasing these forces and enabling them to join in the attack which resulted in the capture of that stronghold. The assault was led by Cushing, Preston and Porter, and is described in Harper's Magazine in an article regarding the service of Lieutenant B. H. Porter as follows:

(Extract from *Harper's Magazine.*)

Accompanied by two of his best friends and two of the most heroic young men the war has developed—Lieutenants W. B. Cushing and S. W. Preston —he took his place at the head of the column. . . . The only survivor of the three young men, Lieutenant W. B. Cushing, the hero of the *Albemarle* capture, whose fame can never die, thus described the scene which ensued:

"Ben looked grave and determined. We were under a terrific fire and the men commenced to get confused. Ben threw himself to the front, flag in hand, and the charge went on. At the palisade by the ditch that surrounds the fort, Ben fell shot through the breast. His last words were, 'Carry me down the beach.' Four of the *Malvern's* and *Monticello's* men raised him and tried to comply. Two were killed. He waved the others aside with a last motion and died."

After the fall of Fort Fisher he rendered extremely hazardous service in taking up torpedoes, repeating his daring examination of the Cape Fear River and its inner defensive works. His shrewd and skillful work in luring in and capturing the blockade-running steamers *Stag* and *Charlotte* is a story by itself, and his construction of a fierce looking "mock monitor" caused the Confederates to evacuate a strong earth-work and caused many a hearty laugh among the sailors of the fleet.

The war was over. In four years Cushing had risen from the position of "bilged" midshipman to the rank of lieutenant-commander, and to a fame that is unique in our navy. The casualty book of the Navy Department contains no mention that he was ever wounded, yet no other man ever encountered the dangers that he passed and survived them, preserved as if by a succession of miracles and sustained through all his trials by a firm faith in the eternal goodness and justice of God.

(CONCLUDED IN SEPTEMBER.)

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PANAMA CANAL TOLLS.

By Rear-Admiral Charles H. Stockton, U. S. Navy.

In regard to the status of canals in general, Prof. John Bassett Moore, in Vol. 3, p. 268, of his monumental Digest of International Law, published in 1909, says:

> While a natural thoroughfare, although wholly within the dominion of a government, may be passed by commercial ships, of right, yet the nation which constructs an artificial channel may annex such conditions to its use as it pleases.

Oppenheim, in his latest edition (Vol. 1, p. 248), says upon this subject:

> That canals are parts of the territories of the respective territorial states is obvious from the fact that they are artificially constructed waterways.

The latter author previously made a statement as follows (Vol. 1, p. 231):

> The supreme authority which a state exercises over its territory makes it apparent that on one and the same territory can exist one full sovereign state only. Two or more full-sovereign states on one and the same territory are an impossibility. The following five cases, of which the Law of Nations is cognizant are apparent, but not real, exceptions to this rule. . . . . (The fourth only is quoted.)
>
> (4) The *fourth* case is that of a piece of territory of which the use, occupation, and control is in perpetuity granted by the owner—state, to another state with the exclusion of the exercise of any sovereign rights over the territory concerned on the part of the grantor. In this way the Republic of Panama transferred in 1903, to the United States of America a ten-mile wide strip of territory for the purpose of constructing, administrating, and defending the so-called Panama Canal. In this case the grantor retains only in name the property of the territory, the transfer of the land concerned is really cession all but in name, and it is certain that only the grantee exercises sovereignty there.

Of course such cessions and such sovereignty can be affected by previous treaties still in force concerning the use of the acquired territory for the purpose of a canal and its incident artificial navi-

gation between two given seas or bodies of water. In 1850 Great Britain and the United States, in the Clayton-Bulwer treaty of Washington, stipulated as between these nations the free navigation and neutralization of a canal between the Pacific and the Atlantic oceans then proposed to be constructed by the way of the River San Juan de Nicaragua and the lakes of Nicaragua and Managua. In 1881 the building of a canal through the Isthmus of Panama was taken in hand under the auspices of a French company, but in 1888 the works were stopped in consequence of the financial collapse of the company. After this the United States revived the project of a canal by the way of San Juan River and the lakes of Nicaragua. In view of the possible completion of this canal, Great Britain and the United States signed, on February 5, 1900, the Convention of Washington, which stipulated free navigation on, and the neutralization of, the proposed canal as set forth for the Suez Canal by the Convention of Constantinople of 1888. Ratification of this convention was wisely refused by the Senate of the United States. In the following year, however, on November 18, 1901, another treaty known as the Hay-Pauncefote treaty, was signed and duly ratified by the Senate of the United States. This treaty, between Great Britain and the United States alone, applies to a canal between the Atlantic and Pacific oceans by whatever route may be expedient and supersedes the Clayton-Bulwer treaty specifically in its *first* article, as that treaty was practically otherwise a perpetual treaty. The *second* article of the treaty reads as follows:

> It is agreed that the canal may be constructed under the auspices of the government of the United States, either directly at its own cost, or by gift, or loan of money to individuals or corporations, or through subscription to or purchase of stock or shares, and that, *subject to the provisions of the present treaty*, the said government shall have and enjoy all the rights incident to such construction, as well as the exclusive right of providing for the regulation and management of the canal.

It will be necessary also to give as pertinent to the matter under discussion the preamble and first paragraph of the *third* article of the treaty which follows and which reads that:

> The United States adopts, as the basis of the neutralization of such ship canal, the following rules, substantially as embodied in the Convention of Constantinople, signed October 29, 1888, for the free navigation of the Suez Canal, that is to say:
>
> 1. The canal shall be free and open to the vessels of commerce and of war of all nations observing these rules, on terms of entire equality, *so*

that there shall be no discrimination against any such nation, or its citizens or subjects, in respect of the conditions or charges of traffic or otherwise. Such conditions and charges of traffic shall be just and equitable.

The reading of these articles, with the words italicized by the present writer, makes it evident that there shall not be any discrimination in favor of any country or person, even in favor of that country which constructs and owns the canal, but which of its own volition yields any claim for preference. There can be, however, as I propose farther on, discrimination as to certain kinds of navigation provided that within that kind of navigation there shall be no national or individual discrimination. There exists within the laws of the United States, as within the statutes of several other maritime countries, two kinds of classification of trade under which its vessels are placed, known as the coasting or coastwise trade and foreign commerce or trade. With us as with several other countries the trade known in French as "cabotage" and with us as the coasting trade, is reserved to vessels flying the flag of the nation whose coasts are concerned. Foreign trade is of course opened to vessels of all flags and all nations. It is my belief that this discrimination of coastwise, as distinguished from foreign, trade should alone distinguish between the tolls or charges for traffic in the management of the Panama Canal. In order, however, to comply strictly with the terms of the Hay-Pauncefote treaty the charges under each classification should, though differing as to class, be the same to all vessels of all nations engaged in the same class of commerce. To make this just and effective, it would follow that our navigation laws should be changed so that foreign vessels be allowed to enter into our coastwise trade between the Atlantic and Pacific coasts, by the way of the canal, and to carry the matter still farther in its impartiality, that merchants and ship owners of the United States be allowed to purchase foreign vessels and place them under the American flag under the same conditions and privileges as if they were vessels built in the shipyards of the United States. Following these rules there would be no danger as to the railways of the United States controlling the coastwise trade of the United States, via the Isthmus of Panama, as they do now, and there would be no danger of the withholding of capital for the construction and management of steamers for this coastwise trade as has been already threatened. The trade would be opened to the world and be beyond the control of any money, railway or shipping trust.

There is a natural division in the coasting trade of the United States, one portion only being necessarily changed in status, by the creation of a minimum toll, by the admission of foreign vessels and finally by a removal of a prohibition of purchase and transfer to the American flag of vessels built outside of the United States. This portion should be known as the coastwise trade of the United States via the Panama Canal. It would include such trade from the Atlantic and Gulf ports of the United States to the Pacific ports of the United States, not only those to continental ports, like those of California, Oregon, Washington and Alaska, but to the insular possessions of Hawaii and the Philippines as well as the smaller insular ports like Guam and Tutuila. This coastal trade very similar to what is known in French as the "Grand Cabotage" is now restricted by law to American vessels. The other coastal trade known in French as the "Petit Cabotage" could still be reserved to vessels that are American built and be confined to stretches of one coast alone on each side; that is, from ports at such points as Portland, Maine, and Galveston and New Orleans and New York on the Atlantic side, and ports on the Pacific side from San Diego to the ports of Puget Sound and Alaska as extremes. Upon the latter coastal trade, or petit cabotage, the present rules of coast trade would apply while the coastwise trade via the Panama Canal would be made so free and open that the world's shipping could enter so as to break down any railway control or monopoly.

There is another feature to be observed in connection with the coastwise trade of the United States via the Panama Canal. If it should have the present restrictions, the same restrictions that are now applied so far as shipping is concerned, it would be a trade denied to other nations in time of peace and hence under the theory and practice of some nations it would place the neutrals which might be disposed, or secured, to engage in it, in time of war, to capture, by a powerful naval belligerent, under what is known as the Rule of War of 1756, and hence this trade would cease to exist. Great Britain and Germany with more powerful navies than our own could command the neighboring seas and hence bring this trade to a standstill. But as a trade open to other nations in time of peace, neutral shipping would be free from capture under that rule in war time and this most important of trades would go on freely at all times.

Thomas J. Lawrence (p. 668, Principles, etc., of International Law, 4th edition) says that:

> Great Britain backed by several important maritime powers still holds that if a belligerent throws open in time of war, to neutrals, a coasting or colonial trade which it confined to its own subjects in time of peace, its foe may treat all neutral merchantmen who take advantage of the permission as enemy vessels. Another group of powers, headed by the United States, holds strongly to the contrary opinion; and unless a settlement is soon reached, the question may become acute and dangerous in a great maritime war.

Great Britain presented a memorandum in the London Naval Conference favoring the doctrine of the war of 1756 as to colonial and coasting trade but it met with opposition, especially from the United States, France and Holland, to the extent that the matter was left unsettled but alluded to in the 2d paragraph of Art. 57 of the Declaration of London, as follows:

> The case where a neutral vessel is engaged in a trade which is closed in time of peace, remains outside the scope of, and is in no wise affected by this rule.

Hence each maritime power is at liberty to act as it pleases in war time and there is nothing to prevent any power from capturing neutral as well as enemy merchantmen, engaged in the coastwise trade via the Panama Canal so long, as is now the case, that foreign merchantmen are denied the right to enter that trade in time of peace.

It may and probably will be urged that it is necessary to retain this coastwise trade via Panama Canal to build up a merchant marine for the United States. In answer it can be stated that for over fifty years this trade has been in the hands of American built merchantmen without having had any material results in the creation of an American merchant marine. In fact our mercantile marine plying on and off our coast has been mainly a subsidiary to our great railway systems, with freight charges so arranged as not to affect its land freight charges when it comes in competition therewith, and really either to feed the lines alone or to give them advantages over competing railway systems. It is this part railway, part water transportation that gives such a controlling situation in trans-continental trade to the Southern Pacific Railway, from New York to New Orleans or Galveston by water and the remaining portion by land in a climate and with a mileage which tends to much profit.

With a minimum toll to all countries for the coastwise trade, with a competition beyond the reach of railway or railway bankers, and with an opportunity of securing the benefit of cheap construction outside of the United States and with the assurance of free transit in war time under neutral flags, this coastwise trade via the Panama Canal opens an opportunity for the development of our Pacific coast by water route which is beyond the possibility of attainment in cheapness, in time and in safety in any other way. Above all there would be no discrimination in tolls against any country or against any citizen or subject thereof.

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THE BAGDAD RAILWAY AND WHY IT IS OF INTEREST TO THE UNITED STATES.

By CAPTAIN ALBERT GLEAVES, U. S. Navy.

The Bagdad Railway connecting Constantinople with the Persian Gulf when completed will stand a "brilliant second" on the list of achievements of the last fifty years, and to quote the *North German Gazette* (March 22d), "with proud joy we shall then be able to look upon a new monument of German work, German application and stubborn German enterprise." It may seem at first glance that the United States has but little interest in the Bagdad Railway, aside from that interest which every educated man must have in an enterprise of such magnitude. As a matter of fact, however, this country has a very definite and distinct concern in Germany's adventures in Asia Minor—the reason is not difficult to discover—a railroad from Constantinople to the Persian Gulf via Bagdad, under the control of one Power means not only monopoly of trade by that Power, but sooner or later colonization also. Now it is fairly certain that, as pointed out recently in the *Spectator,* at this moment Germany is not ready to undertake over-sea expansion; until her fleet can be released from her own coasts she cannot have distant colonies, for colonies must be protected, and in view of the political situation in Europe, Germany has no ships to spare for that purpose. But while her colonization schemes must be held in abeyance for this reason, the tide of emigration is only checked temporarily. But when it flows again, it will be a matter of much interest to us whether it sets westward toward South America or eastward to Asia Minor. Its bearing on our navy strategy is apparent.

The United States has two great principles to uphold, the policy of the Monroe Doctrine and the integrity of the Panama Canal. For nearly one hundred years the Monroe Doctrine has been the barrier to which those nations most concerned have been loath

to accord official recognition, and threats against it have more than once brought the United States to the brink of war. Our position, however, has been so firm and consistent that it is probable that the proposition is at least tacitly accepted. At any rate England is said to have formally recognized our great policy that the American Continent is for Americans. The only other Power from which there has been reason to feel great apprehension on this point is Germany, and this was due to the prevalent idea that her emigration to South America was of such an extent that she would attempt to establish territorial sovereignty over her colonies that had sprung up there as an overflow for her greatly increasing population.

Prince Von Bülow once said that Germans multiply like hares. As a matter of fact the population of Germany has increased from forty-one millions in 1870 to more than sixty millions in 1905; the annual increase is 900,000. Mr. Ellis Barker in his *Modern Germany* says that only 20,000 to 30,000 yearly emigrate, and that immigration is actually three or four times larger than emigration. It is evident from these figures that an outlet for such a teeming population will soon become imperative.

There can be no doubt that for many years the Pan-Germans looked to South America as the logical field for their colonial ambitions, but these dreams of a South American territory could only be realized by a violation of the Monroe Doctrine, and Germany had no desire to quarrel with the United States. If we consider the number and extent of the German population in South America, I believe that it will be accepted that the question of German colonization is not now sufficient to cause anxiety to the United States. If this is true, the fact is one of great importance when considered in connection with our naval policy.

It is worth mentioning that Brazil also has been sensitive on the subject of German colonization in the Western Hemisphere, and it was thought by some writers that the two big Brazilian dreadnoughts were built as a warning that permanent occupation or control of Brazilian territory would not be tolerated. It is now nearly one hundred years since the first German colony was established in South America (at Rio do Sol in 1824), and although Germany had invested in Brazil alone, in 1900, more than $150,000,000, the absorption of her colonists to a greater or less extent by the natives has not been encouraging to German hopes. In

1905 the total German population in South America was 653,500. In the States of Rio do Sol, Santa Catarina, and Parana (1899) 300,000 of these were German speaking, but according to Consular Reports not more than 200 were citizens of the German Empire. The greatest number of emigrants in any one year to South America was 2,500 in 1906. These figures are only approximate, as it is impossible to differentiate between Germans of long residence in the Republics, Germans born within the Republics, and Germans naturalized there. There is no custom of naturalization such as obtains in the United States. All children born on the soil of Latin American countries of German parentage are considered natives in the sense of the word that they are amenable to certain local laws, although they still remain German both by breeding and culture. Where then will Germany plant her colonies? She might expand in New Guinea, on the West Coast of Africa, in the Belgian Congo, China, or lastly in Asia Minor, but there are strong reasons to believe that Asia Minor is the serious objective of her industrial and colonial ambitions. It is evident from Germany's relations with Turkey, and the course of conciliation she has pursued for the last thirty years with the Ottoman Empire, that she contemplates Asia Minor as the logical territory to receive her surplus population, and to develop her trade and commerce, and there can not be much doubt that one of the most eagerly hoped for results of the construction of the Bagdad Railroad is the colonization by Germans of Asia Minor and probably also the neutral zone of Persia. As we have seen the flow of emigration to South America has already been checked; if it is diverted from the shores of South America towards the Middle East, it will probably never run back, and this menace to the Monroe Doctrine will disappear with the opening of the great German trunk line which is to connect Hamburg with the fertile fields of Syria and Mesopotamia.

In regard to our trade relations with Germany, the Bagdad Railroad cannot fail to exert a great influence. For many years after the war with France, Germany found the United States a practically inexhaustible market for the sale of her manufactured products, but the McKinley Bill in 1890 and the Dingley Tariff practically crushed that trade, and encouraged home industries to such an extent that in the course of a few years Germany found the scales turned, and instead of selling her goods in the United

States, American products were successfully competing with German stuff in the shops of Berlin. Now the Bagdad Railroad will open up a great market in Asia Minor for German goods, and it cannot be doubted that American and other foreign goods will be subjected to a high Turkish tariff, just as by the last convention it was proposed to tax all British importations four per cent, with the result that instead of English trade predominating as it does now, it will practically all pass into the hands of the Germans. Our own trade with Asia Minor is considerable as shown by the following table:

Year	Total Exports
1890	$25,669.00
1900	226,655.00
1910	744,504.00

Year	Total Imports
1890	$2,437,108.00
1900	3,823,371.00
1910	7,664,132.00

Thus while on the one hand the Bagdad Railway will have a tendency to soothe our sensitiveness as far as the Germanization of South America is concerned, it contains great possibilities for friction in our trade relations.

It is an interesting situation.

Let us now consider for a moment how Persia will be affected by the Germanization of Asia Minor.

On March 26, 1907, a Russian squadron composed of the battleships *Cesarvitch* and *Slava* and the cruiser *Bogatyre* arrived at Portsmouth, England, and was received with great enthusiasm. The same month the Dowager Empress of Russia made a visit to the Royal Family in London. These visits indicated complete harmony between the two governments. The English press endorsed this attitude and was practically unanimous in assurances of the sympathies of England with Russia. It was evident that something was going to happen, and the entente between London and St. Petersburg was applauded on all sides. This exchange of felicitations proved to be a prelude to the Anglo-Russian convention which was signed on the 30th of August, 1907. By this agreement Persia was divided into three zones. The northern zone was to be under Russian influence; the southern zone which was bounded on the east and south by India was to be under English influence, and between these two lay the remaining

twenty-eight per cent of Persia, the so-called neutral zone—a Tom Tiddler's ground as one writer has it—where Germany will probably not be slow to enter when her railroad system in Asia Minor is completed, and she can then push her trade into the very heart of Persia. In the language of the convention, "the understanding can only serve to further and promote Persian interests, for henceforth Persia aided and assisted by these two powerful neighboring states can employ all her strength in internal reforms." It may be observed that this clause has been the subject of many humorous cartoons, notably one in a recent *Punch*.

However, Russia and Germany came to an agreement in regard to the railway when the Czar and Emperor met at Potsdam in November, 1910. Mr. Garvin, writing on these *pour parlers* (*Fortnightly Review*, February, 1911) says, "By this understanding Russia secures absolutely her interests in Northern Persia, while Germany is relieved from any fear of Russian opposition to the Bagdad Railway." Russia agreed to build the branch line from just north of Bagdad to Khanikin on the Persian frontier, and Germany agreed not to build any other branch road to any other portion of the north Persian frontier. This branch road from Sadiej to Khanikin is considered to be of the greatest importance, as it will not only receive the tremendous flow of the Shiah pilgrimage, but it will absolutely control trade; furthermore it will be of greatest strategical importance, as a line from Khanikin to Teheran will connect the Russian frontier directly with the Persian Gulf. The vast importance of this road to Turkey as well as to Russia will be appreciated when it is remembered that in the future, with the branch lines to Alexandretta and Aleppo, Turkey will be brought on the flank of Egypt, and also in direct communication with the shores of the Caspian Sea.*

* When the railway gets into Syria, and when the gap between Aleppo and Hamah is bridged, it will constitute a line from the Bosphorus to within fifty miles of our Egyptian frontier at Akaba. It will then be an easy matter for the Turks, or any Continental Power allied with them, to transport three divisions to within striking distance of the Suez Canal. To this we could only oppose the one weak division, practically without artillery, which constitutes the Egyptian Army. It is, therefore, a matter for consideration whether we should not fortify, or at least select, positions covering the Suez Canal, which would enable the Egyptian forces to hold out for three weeks till reinforced from England or Bombay. The presence of Lord Kitchener in Egypt is a guarantee that this matter will not be neglected. (*Army and Navy Gazette*, March 9, 1912.)

In the Potsdam "conversations" it was declared by Germany that she had no political interests in Persia, and that she did recognize Russia's special interests there. Finally Russia assured German commerce in Persia the principle of the open door.

To return now to the Bagdad Railroad. In order to have a clear understanding of the situation it will be necessary to refer to the map. The conception of connecting the Eastern Mediterranean with the Persian Gulf by a railroad dates back to 1836, and since then various routes across Arabia have been proposed. The route finally selected and which is now under construction, although not altogether his original line, was chosen by Von Pressel, a distinguished German engineer. He, like many others, was haunted by the dream of a railroad that would connect Berlin with the ancient city of the Caliphs. This was his great ambition, and it was to be the work of his life. His scheme was to have a great railroad station on the Golden Horn, and another at Haidar-Pascha on the Asiatic side of the Bosphorus; this comprehended a series of tunnels, the most gigantic part of the work being twin tunnels under the Bosphorus.

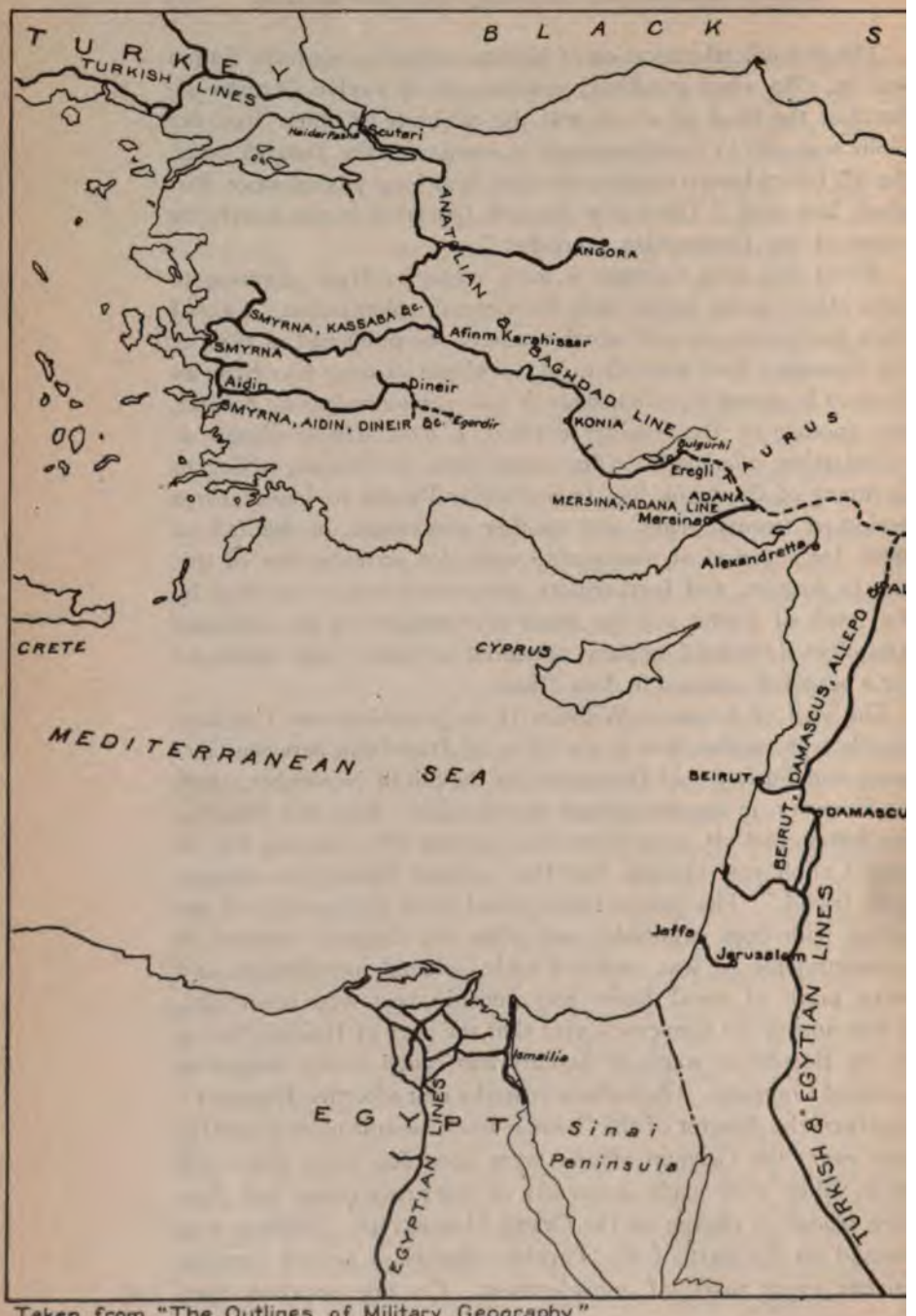
It was also proposed to bridge the Bosphorus rather than tunnel. Herr S. Schneider suggested a suspension bridge, the pillars to be crowned by cupolas and minarets, and at each end armored turrets to command the strait. This enthusiastic engineer completed his description with the statement that trains would run direct from Berlin to Babylon in five days.

The line in general was to run to Konia, thence to Eregli, Adana, Nisibin, Mosul, Bagdad and thence to Busra. In 1902, shortly before Von Pressel's death, the Porte granted to the Bank of Berlin the concession to build this road. It is not the province of this paper to discuss the means by which this concession was obtained, or to comment on the gradual absorption from the French and English by German financiers of practically all the railroads in Asia Minor. Those who are interested are referred to *La Question d'Orient* by Chéradame. It is interesting, however, to mention one or two incidents that illustrate the step by step movement by which Germany won her way into the good graces and beneficent will of the Sultan, and established a predominating influence in the Ottoman Empire, and this against the active opposition of England and Russia, who looked with foreboding and prescient eye upon the expanding schemes of the Emperor.

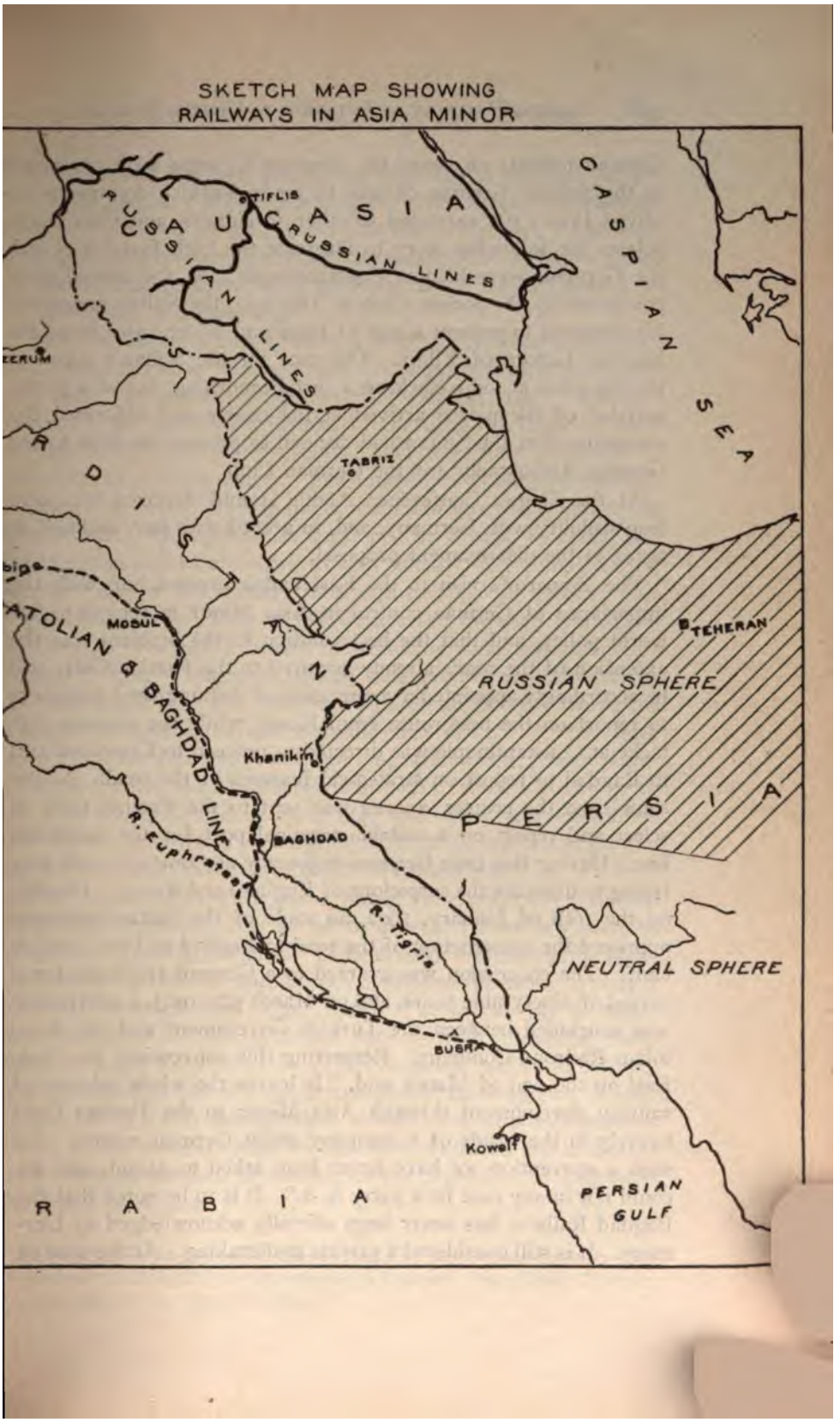
The first official indication of German influence upon the Sultan was in 1882 when a military commission of twelve German officers at the head of which was the celebrated Colmar Von der Goltz was sent to Constantinople to reorganize the Turkish army. As M. Chéradame remarks, the time had long passed since Bismark had said, "The entire Eastern Question is not worth the bones of one Pomeranian grenadier."

About this time German writers began to draw attention to Asia Minor as the logical field for German colonization. Two of these pamphlets are well worth reading, one published in 1886 by Dr. Sprenger, the Orientalist, *La Babylonia, la terre plus riche du passé et le champ de colonisation le plus remunerateur de present,* and another by Dr. Kaeiger entitled, *L'Asia Mineur champ de colonisation allemande.* The concession in March, 1880, to Germany of the trunk line from Haidar-Pascha to Ismidt for a period of twenty years, and another concession, in the fall of 1888, for a period of ninety-nine years for an extension of this line to Angora, and furthermore, the incorporation, in 1899, by the Bank of Berlin and the Bank of Stuttgart of the Ottoman Anatolian Railroad Company, appeared to realize their ambitions for a peaceful conquest in Asia Minor.

The visit of Emperor Wilhelm II to Jerusalem and Constantinople was another link in the chain of friendship between Germany and Turkey. At Damascus, on the 8th of November, 1898, the Emperor, in an after-dinner speech, said, "May His Majesty, the Sultan, and his 300 million Mahometans who venerate him as their Caliph rest assured that the German Emperor is always their friend." The Sultan reciprocated these expressions of devotion with deep gratitude, and when the Emperor arrived at Constantinople he was received with Oriental munificence, and every mark of royal favor was lavishly bestowed upon him. It was during the Emperor's visit that the port of Haidar-Pascha on the Bosphorus south of Scutari was ceded to the Anatolian Railroad Company. Chéradame remarks that after the Emperor's departure the director of the German Bank became more powerful than ever; the German officers were accorded more important duties; they were made inspectors of the army corps, and they were placed in charge of the Grand Manœuvers. Nothing was omitted on the part of the Turkish officials to accord German citizens every mark of consideration. On one occasion even



Taken from "The Outlines of Military Geography"
by Colonel A.C. Macdonnell, Late Royal Engineers


SKETCH MAP SHOWING
RAILWAYS IN ASIA MINOR
CAUCASIA
RUSSIAN LINES
TIFLIS
CASPIAN SEA
RUSSIAN LINES
TABRIZ
MOSUL
TEHERAN
RUSSIAN SPHERE
Khanikin
BAGHDAD
R. Euphrates
R. Tigris
NEUTRAL SPHERE
BUSRA
Kowelf
PERSIAN GULF
ARABIA

German tourists on board the *Augusta Victoria* were presented to the Sultan; German citizens living in Turkish dominions received favors not extended to other foreigners, and Chéradame relates the following story to illustrate the high favor in which the Germans were held in Constantinople. At the annual meet conducted by the Jockey Club at Therapia, the Sultan expressed his intention to present a pair of handsome silver vases from the imperial factory of Yildiz. The race for the Sultan's cup was to take place at ten o'clock on a certain morning, but at 9.30 the marshal of the palace arrived at the course and informed the committee that the Sultan had decided to present the cups to the German Ambassador for the German Club.

At the Hague Conference Abdul Hamid declared his joint responsibility with Germany, and, in accord with her, declined to agree to the disarmament proposal.

The Emperor's visit to the East had impressed him with the importance of German control in Asia Minor in regard to his world policy, and that the best solution to the problem was the extension of the roads already acquired to the Persian Gulf, and he accordingly appointed a commission of distinguished engineers to report on the best route from Konia, while the German Attaché at Constantinople was directed to proceed to Erzeroum and to Bagdad to report on strategical features of the road. At the same time the cruiser *Arcona* was sent to the Persian Gulf to select and report on a suitable terminal port for the projected line. During this time German diplomacy at Constantinople was trying to dissipate the suspicions of England and Russia. Finally, on the 16th of January, 1902, an iradé of the Sultan definitely approved the construction of the road to Bagdad and the Persian Gulf. The concession was granted to a German syndicate for a period of ninety-nine years, and on March 5th, 1903, a convention was concluded between the Turkish Government and the Anatolian Railroad Company. Respecting this convention, Mr. Balfour on the 23d of March said, "It leaves the whole scheme of railway development through Asia Minor to the Persian Gulf entirely in the hands of a company under German control. To such a convention we have never been asked to assent, and we could not in any case be a party to it." It is to be noted that the Bagdad Railway has never been *officially* acknowledged by Germany. It is still considered a private undertaking. At the time of

this concession overtures emanating from Berlin were unofficially made for British co-operation in the construction of the railway, but were rejected on the ground that the terms were inadequate, and that such co-operation would be nothing more than a junior or subordinate partnership in an enterprise in which German interests would be predominant.

The convention which contained forty-six articles was signed at Constantinople in January, 1902, and was kept secret for nearly one year. It was not published until October, 1902. Twenty-seven of the articles conformed to the usual verbiage of such contracts, but there were seventeen that were most favorable to the German concessionaries. The company was allowed eighteen months in which to prepare plans, and eight years to complete the first section. The opposition developed by Russia, however, and other causes caused the work to stop shortly after completion of the first section in October, 1904, and in 1907 the English correspondent of the *Times* in India traversed the road from Constantinople to where it breaks off suddenly some ten kilometers east of Eregli,* "where its pair of rails gauntly projecting from the permanent way and pointing in dumb amazement where the Taurus shares the horizon with the very skies." "They have now" said the London *Times,* not long afterwards, "been pointing thus for five years to the bewilderment of those who, knowing the country, imagined in 1904 that with Germany determined and Turkey desirous to push ahead, the Bagdad line would go forward with inevitable march toward its distant goal."

Politics had blocked the game, but in June, 1908, the Ottoman Government issued a new decree to construct four new sections of a total length of 516 miles. Difficulties in completing the plans and obtaining their definite approval delayed the work so that it was not resumed until May, 1910. The work was to begin simultaneously at four principal points—from Bulgurhi, from Adana toward the Taurus, from the Amanus, and from Aleppo. It was estimated that the entire road would be completed in four years. It was also decided that Mersine and not Alexandretta would be the terminal point on the Mediterranean, and a concession was also obtained to investigate the feasibility of irrigating the plains of Adana.

* This must be an error. The first section of the Bagdad Railway (200 kilometers) to Bulgurhi was completed in October, 1904 (Daily Consular Reports, January 13, 1910, No. 3684).

By the terms of the concession the Bagdad Railway was to be built in sections of two hundred kilometers lengths (about 125 miles); the estimated cost per kilometer was £7,500 to £8,500, and the Turkish government guaranteed a revenue of 15,500 francs per kilometer. The Germans have been severely criticised for accepting the guarantee, and have been accused of "looting" and "milking" the treasury of the Sublime Porte. Their defense of this charge tends, however, to prove that Turkey received great benefits and an ample return for her financial venture. By building the road in sections it was hoped to complete it more speedily to the Persian Gulf. The first section begins at Konia and extends to Eregli, and this line has been open for several years; the first section being across level country was the easiest to construct, the next two will be the most difficult, piercing at it does the Taurus Mountains, which are said to present as many difficult obstacles as the passes of the Swiss Alps. Another feature of the concession was that nothing should be paid for the line which could be cheaply obtained between Busra and Bagdad; this was to compel the company to complete the line, and in the same connection it was forbidden to do any work on the sections south of Bagdad until the road had been completed to Bagdad.

On the other hand the Porte granted the company the rights to use the government timber lands and quarries. They were authorized to build warehouses, construct quays and make harbours; mines along the line were to have preferential rights, and so many branch lines were granted as to give the Germans practically the monoply of all the trade and traffic of Asia Minor.

These concessions were evidently granted in the spirit of the old law, *quando lex aliquid alicui concedit concidere videtur id sine quo res ipsa esse non potest.*

The Germans also secured a concession from the Ottoman Government to construct a pier at Alexandretta which is to be capable of berthing deep-draft ships; this construction must be completed in four years, and also a pier at Payas, ten miles to the westward. This provides an outlet to the Bagdad Railroad in the Mediterranean by linking it to a branch road to Adana.

Another concession of great importance was a system of irrigation by which the waters of Lake Beychecher and Karaviran will be brought down through gorges of Thartshumla River into

the plains of Karaman and Konia, a distance of two hundred miles, and will convert into a garden the arid lands now traversed by the first section of the Bagdad Railroad.

The road will probably not be completed for several years, but without doubt it will be a *fait accompli,* and its effects will be far reaching, not only locally by increasing and developing the resources of the country, but by its influence upon the political and economical situation, and its effect upon established trade routes. The products of the country watered by the Euphrates and the Tigris, that before the days of rail transportation never reached the coast, will be given access to Beirut, Smyrna and Constantinople.

The road will restore to civilization what was once its most fertile portion, and with the completion of the Wilcocks irrigation scheme which involves contracts amounting to seventy-five million dollars, the ancient and desolate plains of Mesopotamia—"the land between two rivers"—will blossom as the rose of Sharon, as it did in the days of Abraham, and the now cheerless wastes of Syria will respond to the call of civilization. The natives will be rescued from the bondage of poverty, and the robber bands that now prowl the desert will abandon their predatory pursuits for agriculture and trade.

The road will traverse the most ancient civilizations of the world; it will cross the ruins of Babylon and Ninevah, and will bring the Mosques of Bagdad within six days of Westminster Abbey. The line pierces the Taurus mountains just north of the Kiliki Pass through which Alexander the Great marched to the battle of Isus. After winding through the rocky gorges of this range it descends the steep eastern slopes and crosses the plains of Adana. At Adana the road sends out two branches, one to the Mediterranean at Alexandretta and Mersine, passing through Tarsus, the birthplace of St. Paul, the other to Aleppo. The main line continues to the east, descending gradually towards Mesopotamia—along this part of the route the country is naked and covered only with sparse pasturage. At Birijik it crosses the Euphrates River, the head of navigation, thence through the wild and uncultivated regions of upper Mesopotamia, intersecting the old caravan route from the northward, then through Nisibin, one of the oldest and most celebrated cities of Mesopotamia, to Mosul, situated on the right bank of the Tigris on the slopes of

the Kurdustan plateau and opposite the ruins of Ninevah, the capital of Assyria. From Mosul, the line runs along the Tigris River two hundred and twenty-five miles to Bagdad, once the pride of Islam and the intellectual center of the Caliphs, and more than once destroyed in the struggle between the Turks and Persians.

A few miles to the southward of Bagdad the road again crosses the Euphrates, and then sweeping in a wide curve continues to Busra. Between Bagdad and Busra, the line touches Hilleh, the place of pilgrimage of the Shiahs, and then passes through the holy cities of Nedehef and Kerbela, in the first of which is the tomb of Ali, the cousin and son-in-law of Mahomet, and in the latter the tomb of Hussein, the grandson of the Prophet, the rejected prophet of the Shias, who fell in the desperate battle of Kerbela with a spear through his heart, and whose death is annually commemorated on the 10th day of the sacred month of Mohurrum.

This point is to be noted as it will be seen that the road thus situated will transport thousands of Mahometans making their annual pilgrimage to Mecca and Medina. Such a railway would of course not only carry all the present volume of passenger trade, but would increase it many fold. For instance it is now impossible for the hundreds of wealthy Jews and others who live in Bagdad to escape from the city for summer vacations. Though the terrible heat regularly registers 115° to 122° F., the whole population, rich and poor alike, stays and swelters because there is no avenue of escape except the Tigris, which leads to the Persian Gulf and India. (Daily Consular Report.)

It will require but little tact on the part of the officials of the road to spread their influence throughout all these wild regions, which the Germans are so anxious to bring under their influence.

Busra is situated on the Shat-al-Arab River, which is formed by the junction of the Tigris and Euphrates, and before it can be made a port of entry the bar at the mouth of the river will have to be dredged, which would considerably increase the expenses of the road, and for this reason the concessionaires were anxious to make the terminal at Koweit on the Persian Gulf, eighty kilometers from Busra, and at present the principal port of the pearl fisheries, but it is quite certain that England, which already practically controls the river trade between Busra and

Bagdad, will forbid any foreign control of Koweit, which at present is under the protection of the British Crown. "Foreign intrusion in that land-locked sea," says one writer, "will threaten our supremacy in India."

In the construction of this railroad—this 1670 miles of continuous tracks—what is Germany aiming at? What will be the effect on her ultimate relations with Turkey? How will it affect her relations with the other Powers most interested? With minor exceptions, Germany holds and controls all the railroads in Asia Minor. This, in the minds of various English writers, indicates that her main object is to make Asia Minor the chief field of her commercial enterprises and gradually extend this field into Persia and down along the new railroad to the Persian Gulf. But on this subject, Herr Von Gwinner, Governor of the Deutsche Bank, in June, 1909, published for the first time a letter from the concessionaires to the Minister of Public Works in Constantinople, stating that they engaged not to "introduce or install" foreign colonies along the line of the road. An English author in the *Fortnightly Review* (March, 1911) regards "as nonsense this bug-bear of German colonists." On the other hand, according to Von der Goltz Pasha, Abdul Hamid stated to him that the Germans should establish colonies on both sides of the Bagdad line, and that he, the Sultan, would expropriate for their behoof broad belts of fruitful lands on either side. "But not until Germany has had it out with England," to quote again from the *Spectator*, "either at sea or by a peaceful conquest of the sea through ship building on an immense scale" will this over-sea expansion begin, and then, "once in command of the sea, over-sea empire will follow as naturally as harvest follows a ripened crop."

It may not be in the interests of European peace for one nation to control such a road, but it is not to be supposed that Germany has any idea of annexing Asia Minor, although the resentment of Russia, in 1903, when she learned that Germany had received the Bagdad concession, may have been based on such a suspicion, and one writer says, "Russian susceptibilities ought to be regarded if European peace is to be maintained. The possession of a Turkish railway by Germany alone, a railway which Russia regards as Germany's first step toward acquiring Asia Minor, would be a standing cause of irritation between the two Powers."

Mr. Lovat Frazer contends that its completion will materially

affect English predominant interests in the Persian Gulf. He thinks that in order to preserve this, the section from the Gulf to Bagdad should be under British control, and says, "no ulterior motives are at present discernible in Germany's desire that England should become her partner in the Bagdad Railway.

Reinsch says, "The countries of Asia Minor, Syria and Mesopotamia have recently come into prominence as of great importance for colonization. We are accustomed to think of this region as composed of vast plains or of mountainous and barren tracts over which nomadic horsemen roam, and which are studded here and there with the ruins of cities of former empires. Few have thought of the industrial possibilities of this vast region; and yet there can be little doubt that after the next few decades it will become a great industrial and commercial center. Though not so immensely rich as China, its resources are abundant and accessible, while its population is sparse. Moreover, European colonists could settle here without being subjected to the inconvenience or dangers of a tropical climate, and without being obliged to modify greatly the habits of their homes. They could without much change transfer their trade and manufactures, and here continue their industrial activities. Of all the regions still available for European colonization, this is by far the most promising."

In the Bagdad Railway England sees a direct menace to the preservation and security of her trade in the regions covered by the road, but she recognizes that if the eastern terminus is Koweit, the *status quo* of the Persian Gulf is threatened, and that would not be tolerated as "an essential feature to the stability of English rule in India." In March, 1911, Mr. Balfour asked what course the government had taken in regard to the proposed branch line from Bagdad to Khanikin, and the continuation of the Bagdad line to the southward; that the question was one of commercial, political and strategical importance to Great Britain.

While the Germans are toiling with the great railroad problem of piercing the Taurus range, and spanning the desolate plains and swampy marshes of Babylonia, the British are planning a military road from Port Said direct to Koweit, and thence across Southern Persia to India. This is what is known as the "All-Red" Line; it has been surveyed, and the project will doubtless

soon pass out of the stage of discussion into something more real and tangible.

But my purpose is with the German road and its consequences. What a writer in the *Contemporary Review* (J. S. Mann) said several years ago in regard to German expansion generally applies equally to her purposes in Asia Minor and Turkey.

> Of course in all this there is no avowed expectation of a German transmarine empire; indeed such hopes are sometimes formally disavowed by the Pan-Germans themselves. The avowed hope is to build up political communities over-sea which shall be German in manners, thoughts and speech, demanding goods of German manufacture, supplying the German empire with raw material and strengthening the bond by taking the overflow of its population to increase and multiply under more favorable conditions than at home.

It has been indicated above how the United States may be affected, but to what extent cannot be foretold now. It may be safely stated, however, that the tide, now checked, of German emigration will in the near future set unimpeded toward the temperate and salubrious climate of the Middle East, and that these regions will be redeemed by German industry and German trade. Already the price of land is increasing, and it is predicted that the fertility of the Euphrates Valley will rival that of the Nile; capitalists are beginning to look along the line of the Bagdad Railroad for investments, and present prospects point to great opportunities in the near future.

I have described the Bagdad Railway itself at some length—and yet incompletely—not only because it is a remarkable example of human endeavor, but for the surpassing interest of its traject across the most ancient civilizations of the world; by the plains of Shinar and Chaldea and through the very site of the Garden of Eḍen, connecting, as by a wire, our own times with the dawn of history. But of course its premier importance is its influence and its effect upon commercial and economical conditions of Asia Minor, for under the control of Germans it represents the latest and most promising attempt of Germany to find a world-market which she has hitherto sought in South America, South and East Africa, and China. Asia Minor seems to meet all the requirements of German needs.

In the first place her people who emigrate there will retain their allegiance to the Fatherland, because amalgamation with an alien race and creed is not probable, and, secondly, with the con-

struction and operation of the railroad will follow, as pointed out above, the working of mines and quarries, and the clearing of immense forests celebrated for their scented woods, and the cultivation of those vast tracts and desolate wastes which only await the upturning of the soil to bring forth in abundance its natural yield of grain, tobacco, nuts, galls and dates. In these regions Germany will find a débouché for her products and manufactures, and practically without a rival, because railroad control means in effect political control, and it is the most important of all industrial undertakings in gaining and maintaining commercial predominence in the exploitation of a new country. These facts are fully recognized, and, so far as Russia is concerned, the Potsdam convention has eliminated the possibilities of a collision with her. With England, however, it is different. The branch road to Khanikin will be a severe blow to British trade with Persia, and unless British finance controls the Bagdad-Busra section, English merchants will probably lose the river traffic which they now control as that will not be able to withstand railway competition. It is thought by some writers that a large proportion of the passenger traffic through the Suez Canal, which in 1910 amounted to 220,000, will be diverted to the land route, but it does not seem likely that the mails between England and India will be taken from the steamers, although the time by rail between London and Bombay will be from four to seven days shorter than the sea route. It is as a freight carrier that the road will revolutionize the regions through which it passes.

So far as this country is concerned, any irritation that may be caused by conflicting commercial interests, especially if preferential rates are granted to German commerce, would probably be referred to the Hague tribunal.

It is worth noting that the founding of the present German navy happened to be practically coincident with the Bagdad concessions. This was in accord with the well established principle that commerce and colonies require an adequate fleet for protection and to maintain communications. No fleet, then no commerce, no new colonies. Napoleon's dream of an Eastern Empire vanished in the smoke of the Battle of the Nile.

The new conditions arising from the establishment of this road cannot fail to influence the political relations of Germany, Russia, England and Turkey, and, if to the extent of changing the dis-

position of their armed forces, then are we also deeply concerned. For such a situation, which will concentrate European endeavors in the middle East, will release us from certain obligations now deemed necessary to our naval strategy, thus granting to our fleet greater radius of action. Furthermore, it will render all the more imperative our naval policy to maintain a fleet sufficient always to hold our own in whichever one of the seven seas it may be called upon to protect the interests of the nation.

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THEORY AND OPERATION OF THE GYROSCOPE AND THE SPERRY GYROSCOPIC COMPASS.[1]

By Ensign R. E. Gillmor, U. S. Navy.

Note.—A short article in the Proceedings of the Naval Institute of September, 1911, by Lieut.-Commander Dinger, gave a general description of the Sperry Gyroscopic Compass. Inasmuch as this instrument has now become an important part of the navigational equipment of our most modern battleships, it is thought that accurate knowledge of its principles, and instructions for its care and operation, should be placed before the service.

Historical.

In the present day of the steel ship and submarine, on which the magnetic compass cannot be considered an accurate and dependable instrument, the development of the gyroscopic compass to its present practical stage represents as important an advance in navigational science as the step the ancients made hundreds of years ago when they discovered the property of the magnetic needle and applied it to directing their ships instead of depending upon observations of the sun, moon and stars. Especially in submarines, and to a certain extent in battleships, with their movable masses of magnetic material, the use of the magnetic compass is becoming almost as much of an approximation as were the observations of celestial bodies the ancients used before the introduction of the magnetic needle.

As an indication of the rapid strides the present generation is making in science, it is interesting to compare the time taken to develop the magnetic compass to the time in which the gyroscopic compass has been developed. The original discovery of the properties of the magnetic needle is variously ascribed to the Chinese, Arabs, Greeks, Etruscans, Finns and Italians; Chinese historians claim the existence of an authentic record, showing that the prop-

[1] A lecture delivered before the midshipmen of the class of 1912 and the officers of the Naval Academy.

erties of the magnetic needle were known in China 2634 years B. C., but there is little definite proof that these properties were applied to nautical use until the beginning of the thirteenth century. Supposing the first intelligent and general application of the magnetic needle to have been about 1300, it required approximately 600 years to develop the compensated magnetic compass. Even the principles of the gyroscope, on which the gyroscopic compass depends, were not deduced until about 1851, so that from that time to the finished and accurate compass a period of only 60 years has elapsed; actually, only about eight of these years have been taken up in the real development of the compass.

THEORY.

The French scientist Foucault was the first to analyze the phenomena of the gyroscope, and to deduce any laws covering its action. This he did in 1851, when he used the gyroscope for demonstrating the rotation of the earth. Inasmuch as there was no means at that time of driving the gyroscope continuously at high rates of speed, great practical difficulties were encountered, and it was chiefly due to his powers of deduction that Foucault was enabled to obtain his theories, which were far beyond the points reached experimentally.

Before stating these laws, which were originally deduced by Foucault, such general terms as "degrees of freedom" and "precession" will be defined. "Degrees of freedom" refers to the manner in which the gyro is suspended; "three degrees of freedom" means suspension allowing freedom of motion about all three axes. Fig. 1 shows a typical gyroscope with three degrees of freedom, *i. e.*, freedom about the axis of rotation *B*, freedom about the axis *EE* and freedom about the axis *GG*. If the band *J* be securely clamped about the wheel *I*, attached to the ring *C*, freedom about the axis *EE* would be suppressed and the gyro would then be said to have a suspension with "two degrees of freedom." The term "gyroscope" is generally taken to mean a rotating mass suspended with "three degrees of freedom" and the term "gyrostat" is generally taken to mean a rotating mass suspended with "two degrees of freedom."

Suppose the clamp *J* in Fig. 1 is released and the wheel *A* is rotating rapidly with the side nearest the observer moving from right to left. If a force be impressed on the near side of ring *D*,

tending to push that side downward about the axis *GG*, this force will be resisted and movement of the gyro will take place about the axis *EE*, the top of ring *C* and axle *B* moving toward the left. Movement of the gyro is thus seen to take place at right angles to the impressed force. This movement normal to the impressed force is called "precession."

Throughout the study of any gyroscopic apparatus it must be remembered that movement of the gyroscope does not take place in the direction of the impressed force but that this tendency to move is transferred ninety degrees in the direction of rotation before it is manifested as motion.

FIG. 1.

Nothing but force caused by angular motion is resisted or causes precession; this angular motion may be about an axis within the gyro or remote from it, but must be angular motion. If linear motion be impressed, no gyroscopic reaction will result, even though the force so impressed be of large magnitude. As angular motion approaches linear motion, *i. e.*, as its radius of action is increased, the less will be its gyroscopic effect.

If the precessional ring *C*, Fig. 1, be clamped to the ring *D* so that precession is not allowed, then forces impressed on the ring *D* will not be resisted, even though they be due to angular motion, thus showing that precession must be allowed or the gyroscope will not have the property of resisting forces impressed upon it. It is for this reason that fly wheels and turbine wheels have no real

gyroscopic effect, precession being suppressed by the bearings in which the shaft is held.

Precession can be very easily and clearly explained by analyzing the actions of the rapidly rotating particles. A circle may be defined as a polygon of an infinite number of sides, and circular motion may be considered as motion about the sides of a polygon having an infinite number of sides. For purposes of analysis and illustration, we may reduce the number of sides to four, as shown in Fig. 2. We can disregard deviations from the straight path, as these deviations are equal and opposite on the sides of the square. Considering the infinite number of particles in the wheel passing

FIG. 2.

first from *A* to *B*, then from *B* to *C*, from *C* to *D*, and from *D* back to *A*, suppose a force is impressed on the end of the axis nearest the observer, tending to push it to the right, that is, tending to force the right-hand side of the wheel downward. In impressing this force there is a tendency to move the paths *BC* and *DA* parallel to themselves, and the particles in passing from *B* to *C*, and from *D* to *A*, have no tendency to be deflected from their original path. However, when these particles move from *A* to *B*, they find there is a force being impressed, tending to make them flow downward, and when passing from *C* to *D* they find a force tending to make them flow upward. Newton's first law of motion states that all matter resists being deflected from its path when once it has assumed a line of motion; the particles in the wheel

resist the tendency to make them flow downward when passing from *A* to *B*, and upward when passing from *C* to *D*, and in resisting they react upward on the upper side of the wheel, and downward on the lower side of the wheel, causing motion of the wheel about the axis *XX*; this motion is termed "precession." The motion of precession causes the particles flowing from *B* to *C* and from *D* to *A* to be deflected from their paths; they resist this deflection, and this resistance is manifested by a stress resisting the impressed force and exactly equal to it. It will be noted that the force impressed has been deflected 90° in the direction of rotation, transferred into motion, and by this motion deflected another 90° in the direction of rotation, where it is manifested in a stress

FIG. 3.

FIG. 4.

opposing the force originally impressed. No motion will take place about the axis *YY*, because if this motion should take place it would immediately remove its own cause. It will be seen from the above that resistance to impressed force is entirely due to precession, so that if precession is suppressed the impressed force will not be resisted.

The phenomena of precession can be very well illustrated by using the analogy of a rotating mass of air, set up by two fans, as shown in Fig. 3. If the air passing through the paper tubes be deflected by moving the left-hand side of the tubes downward, as shown in Fig. 4, these particles in passing through the tube will react, causing precession, as shown in Fig. 5. If the force is

impressed, as shown in Fig. 6, precession will result, as shown in Fig. 7.[1]

Foucault's first law states that any gyroscope possessing three degrees of freedom, that is, free to move in all three planes and

FIG. 5.

FIG. 6.

unaffected by the force of gravity (as it will be if the axis of rotation in the three planes coincide with each other and with the center of gravity), must indicate the rotation of the earth since

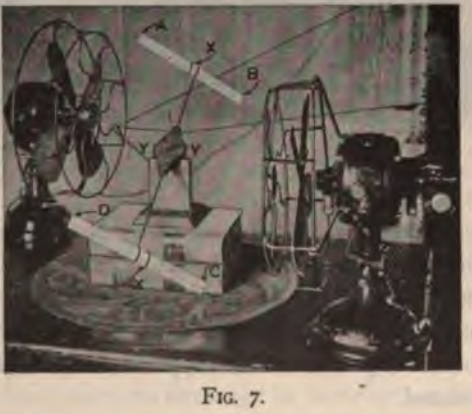

FIG. 7.

[1] An excellent and simple explanation of the causes of precession may be found on p. 150 (5th edition, 1904) of "Dynamics of Rotation," by A. M. Worthington, published by Longmans, Green & Co. This explanation of the starting of precession is devoid of mathematics, popular in character and quite satisfactory. Other references are "Spinning Tops and Gyroscopic Motion," by Harold Crabtree (Longmans, Green & Co.), and "The Gyro Compass," a description of the theory and use of the Auschütz Gyro Compass, published by Elliott Bros, London.

the gyro will continue with its plane of rotation fixed in space, while the earth turns around "under it." His second law states that any gyrostat free to move in two planes only, will, at any place on the earth's surface, other than the two poles, tend to set itself with its axis of rotation in the plane of the axis of the earth itself by reason of the relative rotation of the two bodies.

This second law is illustrated in Fig. 8. Suppose a gyro, suspended so that freedom about the horizontal axis is partly suppressed by gravity, this suspension being so devised that the force

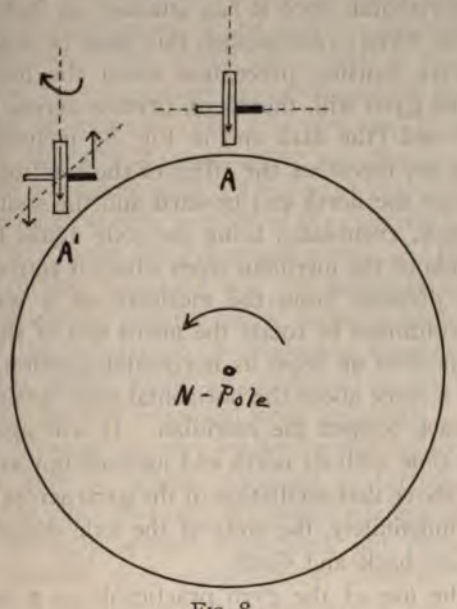

FIG. 8.

of gravity will always tend to place the axis in a horizontal position. Consider this gyro rotating at full speed with axis E and W on the earth's surface, as shown at A. Since the gyro will tend to maintain its plane of rotation in space, the earth in rotating will rotate "out from under" the gyro, leaving it suspended out of the vertical with one end of its axis inclined up from the horizontal, as shown at A', which is the position to which A moves in about 3 hours. The manner in which it is suspended will cause the force of gravity to impress forces on this gyroscope, tending to bring its axis to the horizontal. These forces will cause precession as indicated by the arrow at A'. As the gyro precesses the plane of its

rotation will become nearer and nearer coincident with that of the earth, and, consequently, the earth will have less and less tendency to rotate "out from under" it. Now if the axle if the gyro could be brought to a horizontal position when on the meridian it would persist in that position since its plane of rotation would be coincident with that of the earth and the earth would have no tendency to turn "out from under" it. However, where freedom of motion is suppressed about the horizontal axis only, as in Fig. 8, there exists no force which will bring the axle of the gyro to the horizontal, once it has attained an inclined position, inasmuch as the force to accomplish this must be impressed about the vertical axis, causing precession about the horizontal axis. The axle of the gyro will, therefore, precess across the meridian with its north end (the dark end in Fig. 8) inclined downward. After crossing the meridian, the effect of the rotation of the earth will be to incline the north end upward and the south end downward. This will, eventually, bring the axle again horizontal on the opposite side of the meridian from which it started, and at the same angular distance from the meridian as it was originally. As the earth continues to rotate the north end of the axle of the gyro will be inclined up from its horizontal position, gravity will again impress a force about the horizontal axis causing precession of the gyro back toward the meridian. It will again cross the meridian, this time with its north end inclined upward. It can be seen from the above that oscillation of the gyro across the meridian will continue indefinitely, the ends of the axle describing ellipses as they oscillate back and forth.

To make the use of the gyro practicable as a compass these oscillations across the meridian must be damped in such manner as to bring the gyro to a resting position with its plane of rotation coincident with that of the earth and with its axle horizontal. This is done by impressing a constantly decreasing force about the vertical axis to cause precession of gyro axle toward the horizontal as it approaches the meridian, the ends of the axle describing a spiral as they come to rest on the meridian. The manner in which this is done will be described later.

When the gyro is anywhere but on the equator, another difficulty is encountered, due to the fact that the earth's rotation has two components, one tangential to the surface of the earth, which, as already explained, tends to cause the gyro to precess

toward the north and south meridian, and one normal to the surface of the earth, which tends to leave the north end of the gyro on one side of the meridian.

PROBLEMS IN CONSTRUCTION.

The deduction of Foucault's laws immediately suggested the use of the gyroscope as a compass, either by using it with three degrees of freedom for establishing certain fixed lines in space with which bearings might be compared or by which courses already definitely known might be maintained, or by using a gyroscope with two degrees of freedom, which would place itself in the plane of the earth's rotation, thus indicating the north and south mechanically by the position of its axis. The first idea had to be abandoned because of the difficulty of constructing a gyroscope with its centers of rotation coincident with the center of gravity. The second idea was abandoned at first because of the apparently insurmountable difficulty of driving the gyroscope wheel. As the use of steel in ship construction increased and the necessity of placing the compass in a protected position below decks on men-of-war began to be realized, the importance of developing some device for indicating direction, which would be unaffected by the varying magnetic influences, became more and more apparent.

Magnetic compasses are very markedly affected by such varying conditions as fires in boilers, positions of turrets, cranes, and shock of gun fire, etc. Not only are ships endangered by reason of incorrect or wrongly applied deviations, but there are several instances of peculiar and unaccountable changes in variations, which, in at least one instance, have resulted in running a ship on the rocks. The *Carnegie*, a ship built for scientific research, is now engaged in a trip around the world, for the purpose of checking up and verifying variations as shown on Admiralty, Coast Survey and Hydrographic survey charts. Several errors have already been found and it is reasonable to believe that there are errors which will not be found and that variations will change from year to year, making navigation by the magnetic compass in the vicinity of rocks and islands somewhat hazardous. In view of these facts, as brought out by the development of steel ships and submarines, the investigations of the world's magnetic properties and the increasing need for placing the standard compass in some protected position, so that it can be used after an action,

several inventors have for the past six or eight years been endeavoring to apply the gyroscope for use as a compass.

The problems which confronted the inventors having as their starting point Foucault's second law, as explained before, may be stated as follows:

(1) To suspend the gyro with perfect freedom about the vertical axis so that it is free to precess toward the meridian.

(2) To damp the oscillations of the gyro across the meridian so that it will quickly settle down with its axis north and south.

(3) To constantly impress just exactly the right degree of force to keep it precessing to follow the component of the earth's rotation, which is normal to the earth's surface.

(4) To drive the gyro at a high rate of speed in order to furnish the directive force required.

When these first four problems were solved, the result would have been an instrument which would accurately indicate the north and south meridian, if such instrument could be used only in a fixed position on land. If the instrument were to be placed on a ship, several further problems remained to be solved. These were:

(5) To so suspend the gyro that forces of acceleration and deceleration introduced by movements of the ship will not cause it to oscillate off the meridian, making its readings incorrect. These forces of acceleration and deceleration introduced by the ship are:

(a) Acceleration and deceleration arising from starting and stopping the ship and changing its speed.

(b) Centrifugal forces introduced by the ship in turning.

(c) Forces due to non-coincidence of the center of the gyroscope with the center of oscillation of the ship, that is, forces introduced by rolling and pitching of the ship.

(6) To correct the compass for the deflection, due to northerly and southerly components of the ship's movement, which, of course, act on the compass just as the movement due to the earth's rotation, except, of course, in a very much less degree.

Mr. Edison says that when in the development of machines and apparatus you find yourself proceeding toward greater and greater complexity, you can be almost certain that your efforts are along the wrong line, and that you will not be very successful, but that when you find your developments tending toward greater and greater simplicity, you can be sure that you are proceeding along

correct lines, and that your efforts will most probably be successful.

In the development of the gyroscopic compass this has been especially true. At first the development led to much complication, but the apparatus finally evolved is extremely simple and easily understood.

Fig. 9 is a diagrammatic section of the compass. The gyro wheel itself is mounted with its shaft in ball bearings in the vacuum casing, indicated at *B*, in Fig. 9. This casing is carried in trunnions in the ring *D* called the vertical cardian ring. This

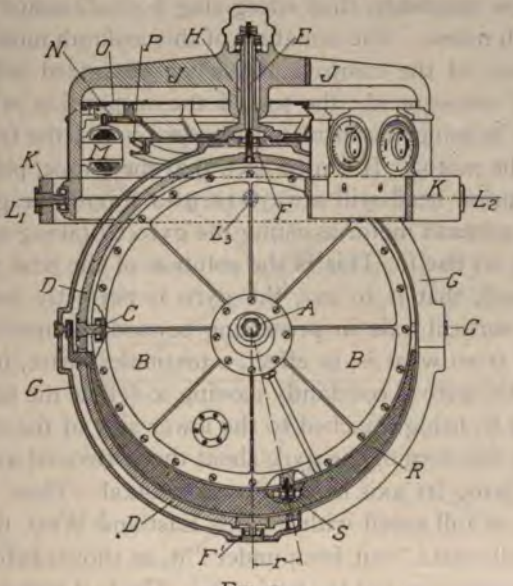

FIG. 9.

ring is suspended in the frame *H* by the suspension wire *E*, the top of which is held in the frame and the bottom of which is made fast to the vertical cardian ring. Attached to the frame and integral with it is a ring *G*, which surrounds the vertical cardian ring; this is termed the "phantom ring," because it is made to follow all tendencies of the vertical cardian ring to move about the vertical axis. Swung in trunnions in the phantom ring and passing through the vertical cardian ring, but not touching it, is the bail *R*, which is attached to the gyro casing at the point marked *S*. The vertical cardian ring is of such shape at the bottom as to permit the bail to swing freely through it. Attached to the ver-

tical cardian ring, and projecting through, but not touching the phantom ring, are two posts, not shown in Fig. 9. On these posts are carried small silver wheels, which rest on a flat commutator, which is carried on the movable frame of the compass, of which the phantom ring and suspension head are integral parts. This commutator has two silver segments, insulated from each other by a narrow piece of hard rubber. Normally, the silver trolley wheel attached to the vertical cardian ring rests on this insulating strip. If the gyro tends to move about the vertical axis, this trolley is moved off of the insulating segment and on to one of the silver segments, thus energizing a small motor *M*, termed the azimuth motor. The armature of this azimuth motor is geared to the frame of the compass and when energized will turn this frame and consequently the top of the suspension wire in such manner as to bring the insulated segment under the trolley wheel and stop the motor. It can be seen that the frame, phantom ring and suspension head will always turn to follow the gyro in azimuth, the azimuth motor assisting the gyro by taking all the work of turning on itself. This is the solution of the first problem, as before stated, that is to say, the gyro is perfectly free to move about the vertical axis in precessing toward the meridian, being suspended from what is, in effect, a torsionless wire, inasmuch as the top of the wire is constantly moving to follow the bottom.

The bail *R*, being attached to the lower side of the casing, suppresses the freedom of the gyro about the horizontal axis, tending always to bring its axis of rotation horizontal. Thus, if the gyro is rotating at full speed with its axis East and West, the earth, in turning, will rotate " out from under " it, as shown before, leaving its axis suspended out of the horizontal. The bail will exert a force through the point of attachment *S*, tending to bring the axis to the horizontal and in so doing will cause the axis of the gyro to precess toward the meridian.

It will be noticed that the bail is attached to the casing eccentrically, so that when the axis of the gyro is out of the horizontal the bail acts not only about the horizontal axis, but also about the vertical axis. This force impressed about the vertical axis opposes the oscillation of the gyro by precessing its axle toward a horizontal position, thus damping the precession about the vertical axis as it approaches the meridian. The amount of this damping constantly decreases as the axle of the gyro approaches the meridian,

and comes nearer and nearer to the horizontal, until, when the axle of the gyro is on the meridian and horizontal, the weight of the bail ceases to act about either axis the weight being then entirely supported by the trunnions in the phantom ring. When on the meridian with axle horizontal the gyro may be said to be suspended with three degrees of freedom and is statically balanced about all axes. In effect, the action of the bail is exactly as if you damped the swing of a pendulum with your hand and constantly lessened the amount of restraining force as the pendulum approached the vertical. This is the solution of the second problem, as before

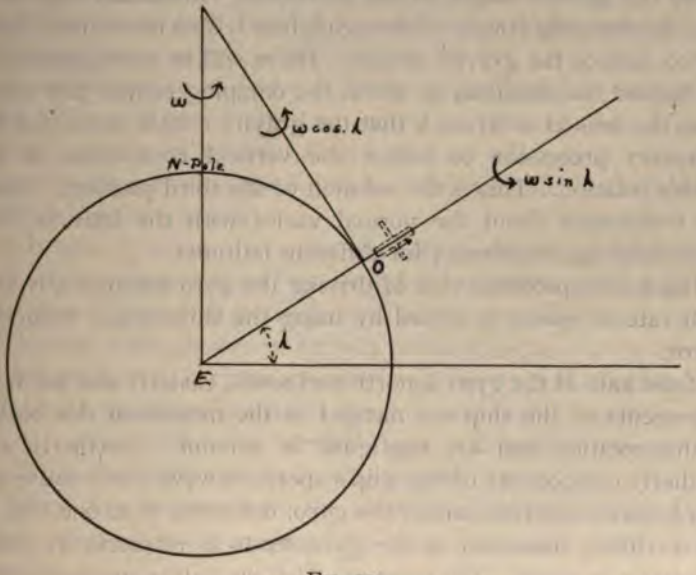

FIG. 10.

stated, that is to say, the oscillations of the gyro across the meridian are damped so that it will quickly settle down with its axis north and south.

Fig. 10 shows that the angular velocity of the earth at any point O can be resolved into two components, $\omega \cos \lambda$, about a tangent to the surface of the earth at the point O and $\omega \sin \lambda$ about the normal to the surface of the earth at that point; λ being the latitude of point O. If the plane of rotation of the gyro is not coincident with the plane of rotation of the earth's tangential component, the earth moves "out from under" the gyro, leaving its axis suspended out of the horizontal. The component of the earth's rota-

tion about the normal to its surface leaves the north end of the axis behind on the east side of the meridian, inasmuch as the gyro tends to maintain its plane of rotation in space.

Considering the gyro *with its axis on the meridian,* and analyzing the effects of the vertical component of the earth's rotation, we see that the earth, in turning from west to east under the compass, which tends to maintain its direction in space, will leave the north end of the axis behind on the east side of the meridian. The moment the axis is left behind the meridian, a portion of the tangential component of the earth's rotation causes a tilt, which introduces the gravity couple of the pendulum. Simultaneously with this, the damping couple of the pendulum is also introduced, tending to destroy the gravity couple. There will be some position of lag behind the meridian at which the damping couple just maintains the axis at a tilt such that the gravity couple can cause the necessary precession to follow the vertical component of the earth's rotation. This is the solution of the third problem. Since the component about the normal varies with the latitude, this position of lag is different for different latitudes.

The fourth problem, that of driving the gyro continuously at a high rate of speed, is solved by using the three-phase induction motor.

If the axle of the gyro is north and south, easterly and westerly movements of the ship are merged in the movement due to the earth's rotation and are negligible in amount. Northerly and southerly components of the ship's speed, however, will cause the ship to move out from under the gyro, deflecting it to one side of the meridian, inasmuch as the gyro tends to maintain its plane of rotation in space. The point at which the bail is attached to the gyro casing is very accurately determined, so that in accelerating and decelerating the ship in starting and stopping, or changing speed, the inertia of the bail acting about the horizontal axis will impress just the right amount of force to orient the gyro to the proper position on one side of the meridian to fulfill the new condition of speed and its damping couple will prevent any oscillation.

Only the northerly or southerly components of the centrifugal forces introduced by the ship in turning need be considered and these forces are exactly comparable to the northerly or southerly components of ship's speed. That is, if the ship, steaming due east, were to swing about a quadrant to a course due north, the effect

of oscillation would be equal to that of the ship starting from rest and attaining speed all on a northerly course. All are, therefore, cases of the same acceleration and are compensated for by the ballistic properties of the bail.

Exact compensation for acceleration of the ship is only obtained theoretically at one given latitude, but the amount of oscillation produced at other latitudes is comparatively slight in all cases, and disappears entirely within a short interval after the ship comes upon a steady course.

Forces introduced by rolling and pitching of the ship are eliminated by mounting the compass in ordinary gimbal rings or cardian mounting, so that all these forces which reach the compass are linear and have no gyroscopic reaction.

As stated before, the gyro is, when on the meridian, suspended with three degrees of freedom and is statically balanced about all axes, so that extraneous forces have no effect on it except by reason of the inertia of the bail acting through the point of attachment to the gyro casing.

It is seen from the above that the fifth problem is solved by the method of suspension and by accurately calculating the point of attachment of the bail to the gyro casing so that the inertia of the bail acting through this point will orient the gyro to its correct resting position to harmonize with the attained speed condition due to latitude, speed and course of the ship, and at the same time will, by its action about the vertical axis, effectually prevent any oscillation from the correct resting position.

It will also be seen from the above that the axis of the gyroscopic compass on a moving ship does not point exactly north because:

(1) It must lag a certain distance behind the meridian in order to introduce the necessary tilt for following the vertical component of the earth's rotation, the amount of this lag depending upon the latitude.

(2) The northerly or southerly component of the ship's speed causes a certain deflection from the meridian. This deflection is, for a given latitude and speed, proportional to the cosine of the angle between the ship's course and north.

In the Sperry gyroscopic compass a mechanical device is used, which, when set approximately for latitude and speed of the ship, will automatically apply all corrections to the lubbers' point, mak-

ing the readings of the compass card referred to the lubbers' point absolutely true. This device will also, at all times, show the amount of the correction that is being applied. It consists of an

FIG. 11.

arrangement of cams, as shown in Figs. 19 and 20. This is the solution of the sixth problem.

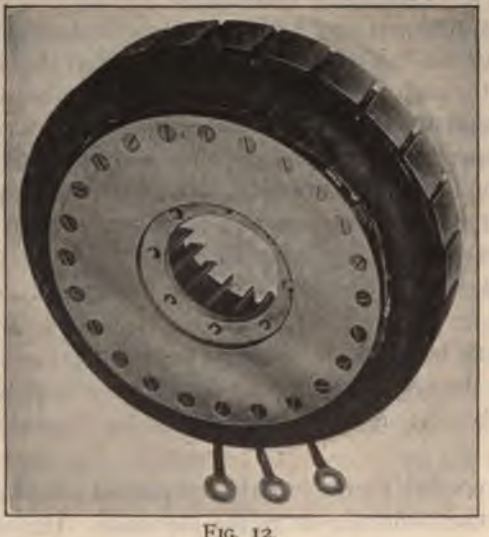

FIG. 12.

DESCRIPTION OF COMPASS AND ACCESSORIES.

The gyro is driven by a three-phase induction motor the stator of which is mounted on the side of the gyro casing and projects inside of the gyro wheel, and the internal periphery of which carries the short-circuited bars of the squirrel-cage induction motor.

The gyro wheel is shown in Fig. 11, which also shows the short-circuited bars and the ball bearings.

Fig. 12 shows the stator of the motor, which is fixed to the side of the casing. This motor is capable of driving the gyro at 10,000 r. p. m.; the normal speed is about 8600.

FIG. 13.

FIG. 14.

Fig. 13 is a side view of the vertical cardian ring, gyro casing and suspension wire. This shows the two posts on which are carried the silver trolley wheels. Levels are provided as shown. Since the axle of the gyro is always inclined out of the horizontal when it is off the meridian and precessing toward it, the position of the bubbles in the levels will tell whether or not the compass readings are to be depended upon. In starting the compass off the meridian, if it is seen by the position of the bubble in the

level that it is not on the meridian, it may be oriented by hand by impressing a force on the upper end of the axis. The manner in which this is done will be described in detail later under Installation, Care and Operation. Just below the level will be seen the hole through which one of the pendulum arms passes.

Fig. 14 is another view of the vertical cardian ring and gyro. This shows how the casing is mounted in the vertical cardian ring. The window on lower right side is for the purpose of getting the speed of the gyro wheel by means of the stroboscope.

Fig. 15 is another view showing the space allowed for the

FIG. 15.

FIG. 16.

pendulum and the point at which the pendulum is attached. The small pipe shown just below the center line on the right is for equalizing the amount of oil on both bearings. The condition of oil and bearings can be seen through the windows on the ends of the journals. The gage at the top shows the degree of vacuum on the casing. The casing is kept under vacuum so that less power is required in driving gyro, there is less heating, and the bearings are kept in better condition. With the new compass no loss of vacuum has occurred for several months. The pendulum is swung in the space shown between casing and vertical cardian ring, its arms go through the vertical cardian ring

without touching it, and are secured in trunnions in the phantom ring which is shown in Fig. 16.

At the top of the structure on the phantom ring is seen the suspension head. Through the slip rings shown just below the suspension head, current is conveyed to the moving system for driving the gyro and for energizing the azimuth motor. The inclined ring shown just below the compass card is the cam which, acting in combination with cams set for latitude and speed, automatically applies the corrections to the lubbers' point, according to the heading of the ship. If heading east or west, no

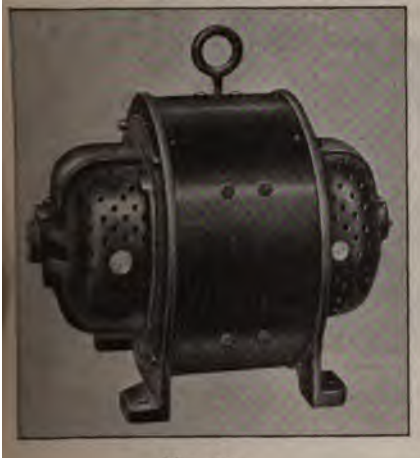

FIG. 17.

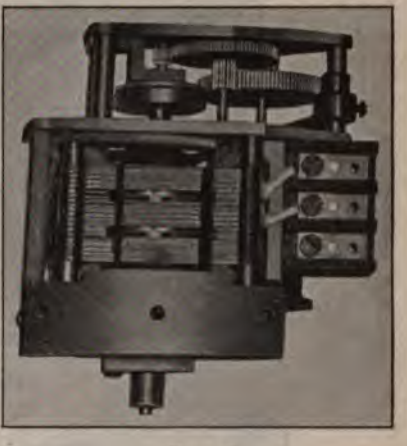

FIG. 18.

correction is applied. If heading north or south, the maximum correction for the particular speed and latitude is applied.

Fig. 18 is a view of the small reversible motor called the azimuth motor. The armature of this motor is slightly offset from its field so that when it is not energized the armature drops and disconnects itself mechanically, by means of the clutch shown, from the gearing driving the compass frame. The motor is driven by direct current of 20 volts. It will be replaced in later compasses by a three-phase A. C. motor for the reason that the problem of reversal is simpler with the A. C. motor, and brushes will be eliminated thus making the clutch unnecessary, as without brushes the motor will not act as a drag on the moving system.

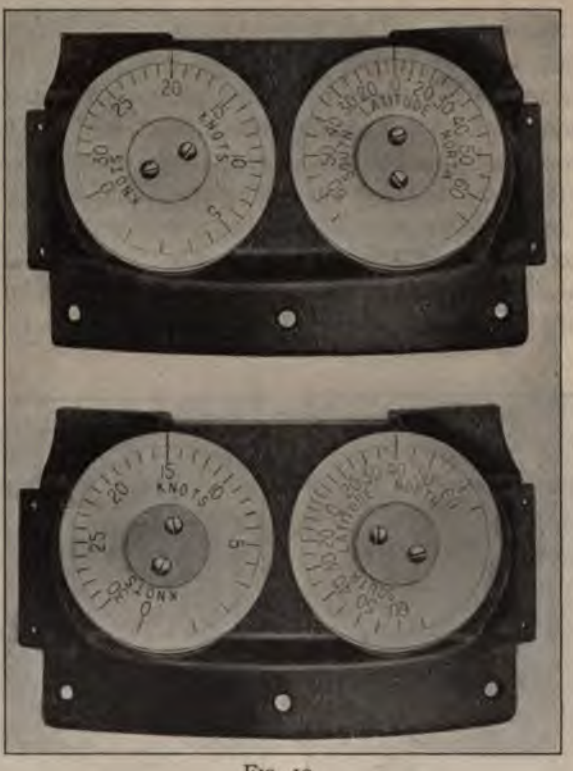

FIG. 19.

FIG. 20.

Fig. 19 shows the front view of the automatic correction device.

Fig. 20 is a back view of this device showing the cams which, when connected to the cosine cam under the compass card, automatically solve the equations of speed and latitude.

Fig. 21 is a top view of the compass showing a correction of a little over six degrees applied to lubbers' point. This also shows method of suspension in gimbal rings. On the upper and lower sides of the inner circle can be seen the silver segments carried on the phantom ring and with which the trolley wheel attached to

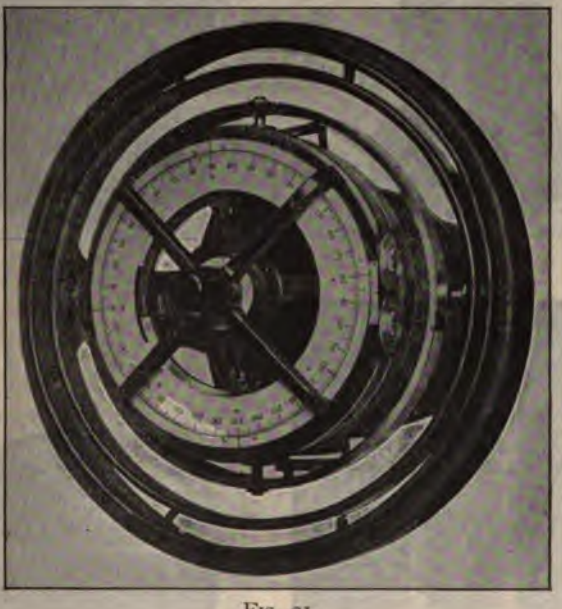

FIG. 21.

the vertical cardian ring makes contact in order to drive the frame of the compass to follow the sensitive or gyroscopic element.

Fig. 23 shows the compass assembled with casing removed.

Fig. 24 shows compass with casing on, cover removed.

Fig. 25 shows it completely covered by its casing. It can be locked in this condition to prevent tampering.

The apparatus which has just been described is called the master compass. Its position in the ship should be below the protective deck, behind the heaviest armor of the ship and as near the metacentric line of the ship as possible. This location would of

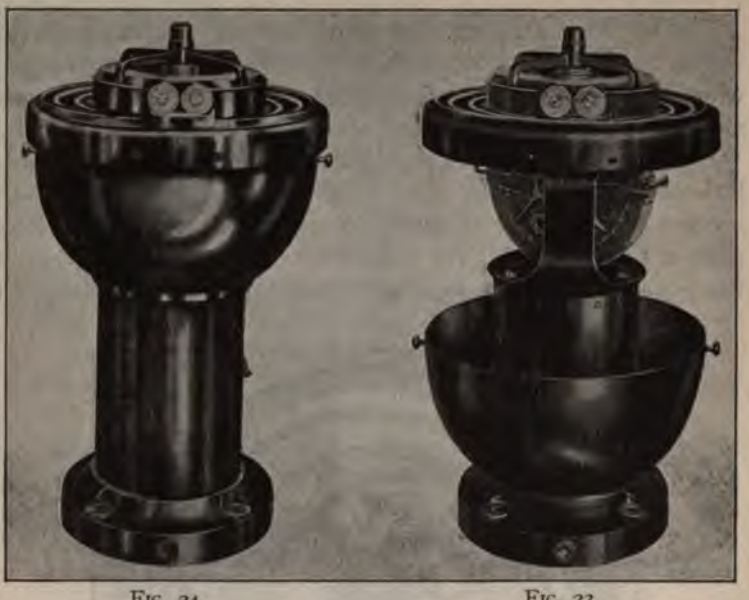

FIG. 24. FIG. 23.

FIG. 22.

FIG. 25.

course remove it from the view of the helmsman and navigator. For the purpose of indicating, to distant stations, the heading of the ship, as shown on the master compass, an auxiliary system is used, called the compass repeater system. These repeaters are placed on the bridge, in the conning tower, in the steering engine room, in the chart house, in the captain's cabin, and wherever else desired. They have a dial similar to the ordinary compass dial controlled electrically by the movements of the master compass, so that the repeaters at all times indicate the same readings as the master compass. This distant control of repeater dials from master compass dials is accomplished by a commutator geared to the moving frame of the master compass, and controlling the flow of current to the poles of a small six-pole motor in the repeaters, a diagram of which is shown in Fig. 26. The armature of this motor is geared to the

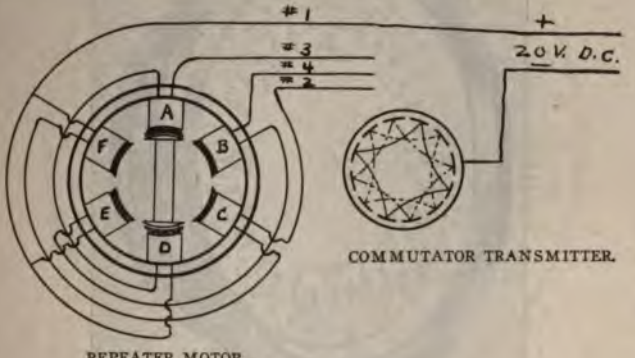

FIG. 26.

repeater dial so that one complete revolution of this armature turns the dials through two degrees. The brushes of the controlling commutator are geared to the master compass dial so that they make one complete revolution with two degrees movement of the compass. Four wires connect the segments of the commutator to the motor; one of these wires is common to all poles, the other three each go to one of the pairs of poles, as shown in Fig. 26. Suppose the brush of the master compass commutator to be turned into such position as to supply current over wire 1 returning it by wire 3, then poles *A* and *D* would be energized and the armature would be drawn into the position shown by the sketch. Now suppose that the brush is turned so as to connect wires 3 and 4 to the negative source of supply as will be the case

if the master compass moves ⅙°, then the armature is drawn half way between poles *A* and *B*, and poles *E* and *D*, or it has moved through 1/12 of a revolution, and the dial through ⅙ of a degree. Since the move takes place half way in the sixth of a degree movement of the master compass, the maximum error of the repeaters is 1/12 of a degree or 5′. These repeaters are portable and may be placed in any position; they are made in two types at present, the binnacle type, which is mounted in gimbal rings, and the wall type, which may be fixed to the wall. Another type is being developed, called the recording type, which is so designed with

FIG. 27.

[illegible] attachment as to keep a complete record of all courses [illegible]. This will be of considerable value to the navigator, [illegible] up courses used in dead reckoning and for [illegible] of the helmsman and officer of the deck.

[illegible] of the wall type of repeater, such as is used in [illegible]'s cabin, etc.

[illegible] new card which it is proposed to use on [illegible] noticed that the degrees are marked in heavy [illegible] of the circle. A design for a repeater [illegible] in the center has been proposed and [illegible] near future. The center or integrating

dial will be so geared to the outer dial as to make one complete revolution for each ten degrees movement of the outer dial. The inner dial will be graduated by degrees and 1/12 degrees so that the heading can be determined and the course steered very accurately. The transmitting commutator is so mounted on the master compass that corrections which are applied to the lubbers' point by the automatic correcting device are also applied to all repeaters.

All wires to repeaters pass through cut-out switches on the switchboard shown in Fig. 22. Each wire is fused so that in

FIG. 28.

case of short circuit on any repeater its fuses will blow, thus isolating it so that its troubles will not affect the other repeaters. In the common wire to each repeater is a small incandescent lamp which can be seen in the center of the switches. When repeaters are in operation and current is flowing to their motors these lamps are lighted. If anything should occur to open a repeater circuit this state of affairs would be indicated at the switchboard by the lamp for that repeater failing to glow.

It will be noticed that the cut-out switches are all double-throw; this permits of connecting any repeater to the master compass or to a device termed the synchronizer (shown at bottom of board)

with which the repeaters may be turned by hand to any desired reading. The synchronizer is used to bring the repeaters to the same reading and to the reading of the master compass.

To synchronize: (1) Throw switch of the repeater or repeaters to be synchronized to the left thus disconnecting them from the master compass transmitter and connecting them to a similar transmitter within the synchronizer. This operation also turns out small lamps which illuminate the repeater dials and which, when lighted, indicate to the helmsman or other person using the repeater, that it is connected to the master compass. (2) Throw lower right hand switch to the left thus energizing a device within the repeater termed the stop magnet which will stop the repeater dial with its zero mark at the lubbers' point. (3) Throw lower left hand switch to the right thus energizing the synchronizer transmitter with direct current at 20 volts. (4) Turn synchronizer dial through a complete revolution. This operation turns repeater dials until their zero marks arrive at the lubbers' mark at which point they will be stopped and held by the stop magnet. (5) Turn synchronizer dial to zero and open stop magnet switch. Repeaters are now at the same reading as the synchronizer and are free to turn with it. (6) Turn synchronizer (and consequently the repeaters) to the reading of the master compass and throw repeater switches to the right thus connecting them to the master compass. (7) Open lower left hand switch.

It will be observed that the cut-out switches have seven legs. One of these is the common wire to repeater motor and stop magnet. Three are section wires to the three pairs of poles in repeater motor, one is to stop magnet and the two remaining go to the binnacle lamp.

The switchboard in Fig. 29 supplies 125 volts D. C. for driving the motor generator, and supplies the three-phase A. C. from this motor generator to the induction motor of the compass. This switchboard also supplies 20 volts direct current to the repeater system and the azimuth motor of the compass. The instruments at the top of the board are A. C. ammeter and voltmeter for showing the current being applied to the gyro motor and the voltage at which it is being supplied. The voltmeter is provided with a switch shown between the two instruments by means of which the voltage of any of the three phases may be determined. The three lamps at the top of the board are in series with each

phase wire and indicate by their glow when the three phases are all in operation. The starting and speed control box for motor generator is shown at bottom of switchboard. The repeaters are provided with two means of 20 volt supply, one from motor generator and one from storage battery. The solenoid operated switch, shown just above starting box, is used for automatically disconnecting the generator in case of failure of its voltage so that battery may remain connected and not discharge back through generator.

FIG. 29.

A reversing switch is provided with which two of the phase wires to the gyro motor may be reversed, thus reversing the motor to assist in stopping gyro when shutting down the compass. Another switch is provided for short circuiting the phase indicating lamps in case any of them burn out. The shorter arm on the starting box is used for energizing the motor field. The longer arm is for the purpose of controlling motor-armature resistance and motor field resistance; *i. e.*, for starting the motor and controlling its speed.

The usual no load and overload releases are provided which reset starting arms when circuit supplying motor generator is opened or overloaded.

Fig. 17 is a view of the motor generator. It has a capacity at the generator end of ¼ K. W. with unity power factor and is about 10 inches high and 14 inches long.

INSTALLATION.

When installing the gyro compass outfit the master compass and the two switchboards should be placed together below the protective deck behind heavy armor, and as near the metacentric line of the ship as possible. The central station on board battleships has usually been found to be the best location.

The navy standard practice should be followed as to conduit, cable and connection boxes in putting in the wiring for repeaters.

The installation should be placed under the care of a good electrician who is not a watch stander and who can give most of his time to keeping the outfit in good condition. One of the electricians in the fire control division will be found to be a good man for this. On the *Delaware* the electrician who cared for the compass also looked out for the condition of the ship's service and fire control telephones, but as he was an exceptionally good man, he had no difficulty in doing both.

The switchboards and motor generator should be given the ordinary care usually given such electrical appliances, that is, they should be kept clean, binding posts tightened, etc.

The master compass and repeaters should be kept clean and free from dust. Master compass casings should be kept on at all times except when adjusting, starting or making observations of compass. Level of oil in bearing cases should be frequently noted—it should never be filled above center of the glass and may be allowed to fall quite low before refilling. A special oil which is furnished with the compass should be used.

STARTING (preliminary adjustment).

Before starting it is well to remove the silver trolley wheels and examine contacts carefully. Replace trolleys with a small piece of paper inserted in trolley arm in such manner as to hold it out of physical contact with silver segments—note position of sensitive element—it should be in an exact central position and

when moved away from that position should return to it by oscillations with period of from 10 to 20 seconds. If sensitive element does not return to a central position relative to frame, or phantom ring, the head of suspension wire should be shifted until it does. This is done by means of a tangential screw found under the cap over the suspension head. Note positions of bubbles in levels—levels should be adjusted so that when compass is at rest the bubbles are at the southerly end—when running in 40 N. Lat. the bubbles will be in the center. All compasses are adjusted to run with level in 40 N. Lat.

The levels should never require adjustment. If on examination they are found to be out of adjustment, one should look carefully over the gyro casing to see if any weights have been shifted or heavy objects allowed to accumulate thereon. Remove paper from trolleys and test azimuth motor with D. C. power on. Motor should respond freely in either direction and should not cause an oscillating motion of frame when gyro is brought to rest.

TO START (see Fig. 29).

(1) See that all switches on gyro energy board are open—starting arms back. Tell distribution room to throw power on gyro system.

(2) Throw power on azimuth motor.

(3) Throw power on motor generator.

(4) Connect gyro motor to motor generator being careful to see that double-throw switch is thrown into position marked running and not position marked stopping.

(5) Both starting arm and generator field control arm being thrown to left, the motor armature circuit is open and all resistance is cut out of generator field and motor field.

(6) Throw the shorter arm all the way over to the right, thus energizing the motor field. Move the longer arm to the right, thus gradually accelerating the motor-generator until the A. C. ammeter shows a current of three amperes flowing to the gyro motor. Voltage will then be about 40. As gyro gradually accelerates, current will drop and voltage will rise. As current tends to drop keep it at 3 amperes by moving starting arm to the right cutting out more and more armature resistance until gyro is nearly up to full speed, as will be shown by voltage of about 120 with current of 3 amperes. Starting arm by this time will have cut out all armature resistance

and will be on speed regulating points to the right which weaken field of motor by cutting in field resistance, thus increasing the speed (shunt motor). Leave starting arm in this position and as gyro gradually accelerates up to full speed current will drop to one ampere and voltage will rise to 130 which is the proper criterion for correct speed.

In accelerating to full speed the gyro may pass through two critical stages at which the period of revolution is synchronous with the characteristic of the shaft thus causing vibration of the sensitive or gyroscopic element. It is well to steady the sensitive element with the hand in passing through these stages although no harm will result.

About twenty to twenty-five minutes are required to accelerate the gyro to full speed.

If, in starting the compass, there is any need to get correct readings immediately, the axis may be placed on the meridian by hand in the following manner: When the gyro is running at full speed bring its axis level by exerting a slight torque on the trolley posts in the direction in which it is desired to make the bubble go. After leveling the gyro watch the bubble and time its departure as it moves from the center of the level. The number of divisions on the level over which the bubble moves per minute, multiplied by five, gives approximately, the displacement in degrees between the axis of the gyro and the north and south meridian. The direction of north is shown by the direction in which the bubble moves. The compass may be set approximately, in accordance with the displacement ascertained from the action of the bubble, by applying moderate vertical presure on the end of the axis which is highest. Pressure on the north end of the axis causes westerly movement and vice versa, but it is only necessary to remember to exert a force on the highest end tending to force it to a normal position and in that way assist the action of the bail. When the gyro has attained its normal north and south position the bubble will remain stationary or will vibrate equally on both sides of its normal position if the ship is rolling.

(7) After the gyro has been brought to full speed and is on the meridian, synchronize all repeaters and connect them to the master compass.

When the gyro is running careful attention should be paid to all switchboard instruments and indicators to see that circuits are in normal condition.

In case of failure of the direct current supply to the motor generator the gyro will continue to run with sufficient speed to maintain its directive force for about two hours. In case of momentary failure of direct current, such as would be caused by a fuse blowing, the gyro motor should be disconnected from the generator. When supply is re-established the motor generator should be brought to normal speed before connecting it to the gyro motor.

The phase indicating lamps at the top of the board in Fig. 29 are normally short circuited by the three-pole switch below the ammeter. To ascertain whether or not all phases are in operation open the three-pole switch; a glow in all of the three lamps indicates that current is flowing in all phases. In case of failure of one phase speed of the motor-generator should be reduced to about two thirds of normal running speed. Gyro motor will continue to run on two phases but if shut down will not start unless all three phases are operative.

The compass may be left running for months without any appreciable wear on the bearings, but it is best to shut down when the ship is to be in port for more than two or three days.

To shut down: (1) Stop motor generator, (2) disconnect gyro motor, (3) throw gyro motor switch to position marked "stopping," (4) start motor generator and run at a sufficient speed to maintain a reversing current of three amperes on the gyro motor, (5) disconnect repeaters, (6) open twenty volt supply to azimuth motor and repeaters, (7) stop motor generator. Gyro wheel will come to rest in about twenty minutes. Azimuth motor should be kept energized until gyro wheel has come to rest.

Remember (a) to keep the compass covered, (b) to start gyro at least two hours before getting underway, (c) to turn current on azimuth motor before starting gyro, (d) to accelerate gyro by maintaining a flow of three amperes, (e) that a correct running speed is indicated by a flow of one ampere at one hundred and thirty volts, (f) that compass will come to the meridian automatically by reason of the earth's rotation but may be placed on the meridian by hand in much less time, (g) that the azimuth motor should be kept energized while stopping the gyro.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AN IMPROVEMENT IN FLOATING DRY DOCKS.

By CIVIL ENGINEER A. C. CUNNINGHAM, U. S. Navy.

Experience shows that with steel floating dry docks, unless carefully and continuously preserved, rusting will soon set in and the deterioration will be rapid. This deterioration is the most rapid on the interior of the structure, and next on the submerged exterior portions. The surfaces which are continuously exposed and easily accessible are easily preserved. The preservation of a steel floating dry dock depends on its periodical self-docking, by which the submerged exterior and interior portions are brought above water and may be dried, cleaned and painted. Self-docking is ordinarily a slow, tedious and expensive operation, and while in progress places the dock completely out of use.

With many steel floating dry docks the expansion of the structure to meet new conditions is also impossible. The docks are designed for a certain maximum ship and can not be increased beyond this limit. This limitation is partially overcome in docks of the independent sectional type, where a new section can be added to the existing sections, and the dock thus lengthened and proportionally increased in lifting power. This, however, does not cover the case where it may be desirable to increase the lifting power without increasing the length.

To further increase the usefulness of floating dry docks, and to overcome the limitations previously mentioned, the author submits the design shown in the following figures:

Fig. 1 is a sectional side elevation; Fig. 2, a plan view; and Fig. 3, an end elevation; all showing a pontoon self-docked. It will be seen that this design is a combination of the principles of the Rennie pontoon dock and the Cunningham sectional dock, in which the sections are integrally connected together above the normal water line. The first gain is in the ease and rapidity of self-docking. There is no change or disturbance of moorings.

A pontoon is taken out sideways and docked as an independent vessel. If an extra pontoon is provided, the dock is only out of commission during the time taken to shift the pontoons. An important gain is the ease of continuous and thorough preservation. The pontoons may be periodically docked in rotation, and the preservation effected before deterioration has begun. In fact,

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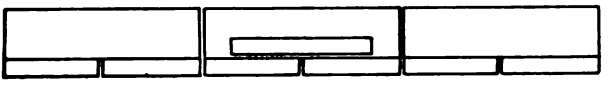

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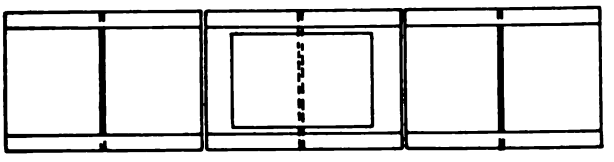

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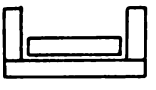

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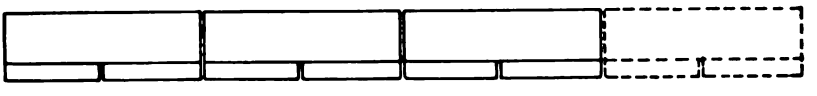

with this type of dock there need be no deterioration from rusting, and the dock can be kept in continuous use at the same time, when an extra pontoon is provided, as in Figs. 1 and 2.

This design of dock has the advantage of possible longitudinal expansion, the same as an independent sectional dock, as shown in Fig. 4. In this figure an original three section dock shows a fourth section added in dotted lines. This has an added ad-

vantage over the independent sectional type, in that, if the four section dock is separated at the center into two smaller docks, each part retains the self-docking feature.

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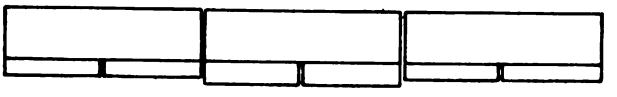

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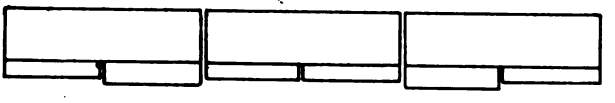

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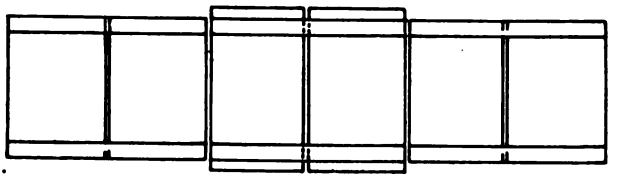

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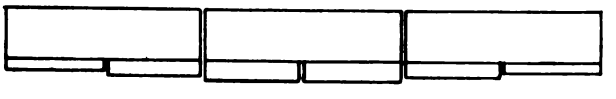

As a floating dry dock will lift a ship longer than itself, it may become desirable to increase the lifting power of a dock without increasing its length. This may be done with this type of dock by replacing some or all of the original pontoons with deeper ones as shown in Fig. 5. These new and deeper pontoons may also be

shifted to points of maximum load for special cases, as shown in Fig. 6. This increase in lifting power may also be accomplished by increasing the length of the new pontoons instead of the depth, as shown in Fig. 7. Where increased lifting power is secured with longer pontoons, the original pontoons may be lengthened to advantage, and with the least change in the original structure.

This type of floating dock also admits of the most economical original design where that becomes a matter of importance, as shown in Fig. 8. The depth of pontoons and the gauge of material in the side walls may be proportioned and distributed with reference to the curves of weight and stress so that there will be the least excess of material over that required at any point.

The construction of this dock becomes the simplest of any yet proposed, and can be progressively and economically carried on by a small force. The pontoons may be built in succession and their side or end launch is of the simplest nature on account of their comparatively small size. Two pontoons having been gotten overboard, the erection of the side walls on one section may be begun in place. When two sections are completed they will be connected with each other, and so on progressively until the entire completion of the dock. For the greatest elasticity in use, it is contemplated that each section will be fitted with its own pumping plant, all of which may act in unison in the completed dock. With the completion of one section, the continuance of the construction may be made independently of the launching ways, as the succeeding pontoons may be built directly on the section which has been completed.

While the dock admits of progressive construction, it is also possible of the quickest construction of any yet proposed. All pontoons may be constructed simultaneously and the side wall material fabricated at the same time. With the launch of the pontoons the erection of the side walls on all pontoons may be proceeded with, and the completed sections all assembled at once. It seems a safe prediction to say, that under a sufficient stress a dock of this type of any magnitude could be constructed in from three to four months.

Summarizing the preceding statements, we have in this proposed type of self-docking steel floating dock the following advantages and improvements: A dock that can be built either progressively, or in the shortest possible time of any type yet

proposed on account of the possibility of working on all parts at once. One that can be constructed in a very limited space with small facilities, and completed and assembled at the most convenient point. A dock that begins to be operative with the completion of any one section. One that can be expanded in lifting power alone, or in dimensions and lifting power at the same time, and such expansions made while the dock remains in use. Of more immediate and constant importance, a dock that can be continuously preserved with the least trouble and expense, without risk, and be continuously available for use at the same time.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE DESTRUCTION OF THE U. S. STEAM FRIGATE *MISSOURI* AT GIBRALTAR, AUGUST 26, 1843.

By Surgeon A. Farenholt, U. S. Navy.

The loss by fire of the U. S. Steam Frigate *Missouri* at Gibraltar during the night of August 26, 1843, was a most deplorable accident and attracted at the time more widespread comment than any other similar accident has before or since. It came at a time when the U. S. Navy had recently suffered an unfortunate series of disasters. The sloop-of-war *Peacock* was lost off the Columbia River bar, July 18, 1841, all saved. The sloop-of-war *Concord* was beached and became a wreck, October 2, 1842, off the East Coast of Africa, three were drowned, and the small sloop *Grampus* foundered off Hatteras during the early part of March, 1843, and all hands were lost.

The adoption of steam as a method of propulsion for vessels of war was first used by the United States, and the first vessel so equipped was the *Fulton the first,* built at New York in 1814. She was a hybrid vessel of 2000 tons, mounting a battery of 30 guns; she had two separate hulls with the propelling paddle wheel between them, the engines being in one hull and the boilers in the other. This vessel remained at the New York Navy Yard practically her whole life, much of the time as a receiving ship, and finally was destroyed there by an accidental explosion, June 4, 1829. Our next steamer was the *Fulton the 2d,* a small paddle vessel which did considerable work and was finally wrecked near Pensacola in 1859. The third was the small tug *Engineer* purchased in Baltimore in 1836, and used chiefly at the "Norfolk station," as it was called in those days.

With this meager ancestry the more regular steam navy may be said to have been inaugurated with the building of the *Mississippi* and the *Missouri,* two splendid sister ships, the equal of any

in the world and the pride of the country. They were built under the personal supervision of Commodore M. C. Perry who has been referred to as the "father of the steam navy." They were laid down in 1839, and completed in 1841, the *Mississippi* at Philadelphia and the *Missouri* at New York. The former proved to be a most useful vessel, she made six cruises in all, circled the globe twice and was finally burnt to prevent capture in the river whose name she bore, March 14, 1863. Strangely enough both of these pioneer ships met their ultimate fate in the same manner, destruction by fire. Some data concerning these vessels may prove of interest as showing the wide step between them and the modern *Dreadnought*.

Class, steam frigate, paddle.
Rig, bark.
Tonnage, 1692.
Cost, $567,500.
No. of engines, 2; kind, side lever.
No. of boilers, 4: kind, flue, copper.
Diam. cylinders, 75 inches.
Length of stroke, 7 ft.
Diam. paddle wheel, 28 ft.
Width paddle wheel, 11 ft.
Width of paddles, 3 ft.
Dip of paddles, 6 ft.
Number of paddles, 21.
Spread of canvas, 19,000 sq. ft.
Av. speed knots, 7-10.
Crew, 270-500.
Battery, 2 10-inch; 8 8-inch.
Length, 225.
Depth, 23.6.
Av. rev. per min., 11.
Av. steam pressure, 12 lbs.
Sq. ft. fire surface, 5400.
Av. consumption coal per hour, 2800 lbs.
Tons of coal carried, 550.
H. P., nominal, 458; actual, 650.

The following account of the *Missouri's* unfortunate loss is based upon a pamphlet published at Boston in 1843, by William Bolton, one of her crew.

Under the command of Captain John Thomas Newton, with a crew of 384 men, the vessel left Norfolk during the afternoon of August 5, 1843, having on board the Hon. Caleb Cushing, the recently appointed minister to China, and his suite, who were to be carried as passengers as far as Alexandria, Egypt. Her only service prior to this diplomatic mission and subsequent to her original commission was a short cruise to the West Indies, during which an unsuccessful attempt had been made to turn her smoke into her paddle-wheel houses. She was the first steam frigate to cross the Atlantic, and made the port of Fayal in 12½ days. During the passage over it was recorded that the deck force did not take kindly to the frequent hoisting of ashes, a new duty for them, but rather an old one at the present time, and, that in order

to stimulate cheerful compliance with such orders from the boatswain's mate as, "lay aft all the st'b'd watch of the fore topmen and hoist cinders," extra grog was frequently served. The ship was coaled from a small English brig during the short stay at Fayal. There the crew enjoyed the fresh fruits brought off by the bumboatmen and the master at arms had the usual trouble with visitors over liquor smuggled on board, often in skins secreted in cheeses or fowls. The ship remained there over Sunday and the captain, as was then customary, performed divine service. Fires were kindled and under sail and steam the ship left the harbor Sunday afternoon. The coal recently taken on board was found to be excellent in quality and the "incrustations on the fire grates" considerably reduced, the "cinder hoisting lessened one half and the speed increased.

During the afternoon of the 25th, the ship anchored at Gibraltar in "a quarter less four, abreast of the quay." Early the next morning hammocks were piped, boats lowered, tackle got up and rove; breakfast was piped and the bumboats came and left the ship. At 10 o'clock the port was saluted with 17 guns which was answered from the Rock and, the water and coal having come alongside, the men were told off to get it on board. This work lasted all day without incident. Suddenly, at about five minutes past eight, and apparently without slightest warning, a boatswain's mate who was stationed on the st'b'd hammock netting attending to the whipping of the bags on board, saw flames rising from the fore hatch. He cried "ring the bell! fire!" and after some slight preliminary confusion, during which a young drummer boy becoming frightened after giving his drum a few taps, ran aft and dived overboard through one of the open stern ports, all hands were got up and the fire energetically fought. Fire lines were formed and every bucket in the ship requisitioned; the "double boxed engine pumps" were manned and fire hose stretched.

The fire * had started in the fore hold where hemp, oil, turpentine and paint were stored and had very rapidly gained headway. The first lieutenant was on deck before the bell ceased ringing. He ordered the usual preparations and proceeded below at once to

* Captain J. T. Newton, the commanding officer of the *Missouri* when she was burned in Gibraltar harbor, August 26, 1843, reported to the Secretary of the Navy that the accidental breaking of a demijohn of turpentine, the fluid from which fell into a lighted lamp beneath, set the ship on fire.—C. W. S.

ascertain the origin and condition of the fire. With the gunner's mate they tried to get to the forward magazine where 2900 lbs. of powder were stored but the flames cut them off. Again entrance was tried through the manger gratings but it also was unsuccessful. The whole berth deck was soon on fire and flames shot up through the after hatchways. The gunner was given the keys to the after magazine in which 5745 lbs. of powder were stored, and ordered to " drown " it immediately, this was done. The first lieutenant then went to the fire room and, after consultation with the engineer officers, it was decided to open the Kingston valves. These were twelve in number, in bottom and bilge, and were 4½ inches in diameter. The two injection pipes, 6 inches in diameter, were also opened, and in a few minutes the water had risen to about four feet above the floor plates, driving the men on deck. A sentry was placed over the spirit room. Arm chests containing powder horns and loaded shells were hoisted by both marines and seamen and thrown over the side. The engine pumps continued to work but from this time on it became the usual story of an uncontrollable fire on a wooden ship, a fight against certain loss. A gun was ordered to be fired, an eight inch as there were no saluting guns on board, but, on account of there being many small boats around, it was not done. A signal gun was however fired at this time from the Rock, and, by order of the governor, the gates were thrown open, at that time an unprecedented courtesy. Four blue signal lights were displayed from the doomed ship, two on the " larboard " quarter, and two on the taffrail, which were answered at once by a 42 pdr. from the British line-of-battle ship *Malabar*, 74. A boat from the dockyard with 36 convicts and an engine appeared and flooded the berth deck through an after st'b'd air port. *Malabar's* pinnace came under the fore chains with a hand engine and two carpenter's mates and the latter endeavored to scuttle the ship through the side but, on account of the network of bolts, this could not be done. They then stopped up the scuppers and played water through the port hawse hole. Then came the Royal Irish sappers and played water through the st'b'd forward air port. The American ship *Rajah* and the American bark *Pons* got out their boats and saved much property, public and personal; the chronometers, paymaster's books and specie.

By this time there was about eight feet of water in the hold and the ship, having previously swung with the light wind, was touch-

ing the bottom. The British steamer *Locust* got underway and coming close aboard hailed and offered to tow the *Missouri* into deeper water, but this could not be attempted. The ends of the ship were isolated and crowded with men, the waist was a mass of ever increasing flames.

The captain had stood on the top of the wheel house during the greater part of the conflagration and, seeing the danger and uselessness of further effort, ordered "men save yourselves." Without unseemly haste the ship was abandoned. Both "steering-sail booms" carried away with the weight of men but all hands were rescued by the many boats which formed a ring about the ship. Of the crew's pets a big Newfoundland dog was saved but a bear, a mascot from the *Ontario*, could not be induced to leave and perished on board.

Within seven minutes after the captain had left the side the mainmast fell and, shortly after, the two forecastle Paixhan guns dropped through the deck, one of them exploding. At about 2 o'clock in the morning the forward magazine, the vessel having careened to port, detonated and tore the whole forward part of the ship out. The hulk and the coal burned until past 8 o'clock the following morning. About 200 of the crew were taken to the *Malabar* where food, rest and clothing were supplied them. "Middies" were described as "running around with lieutenants' uniforms reaching nearly to their heels," and the men "resembled a parcel of Mexican recruits or Botany Bay deserters." The next day was Sunday, and after the Episcopal service had been read by the captain, the crew proposed to take up a collection for the unfortunates but this was declined, chiefly because the *Malabar's* men had recently helped two other crews under similar circumstances. The American ship *Rajah* was at once chartered to take the men to Boston and on Sunday evening they were put on board, the remainder of the ship's company being rounded up from the various vessels in the harbor, from the Barracks and from the wine houses ashore. No one was lost. On the following day the captain mustered his crew on the *Rajah*, thanked them and "recommended a continuance of discipline and subordination."

A week was spent in saving property which included portions of the rigging, sails, two bowers, st'b'd sheet, kedges, fifteen fathoms of chain, ship's coppers and a quantity of iron.* Captain

* Captain Newton was tried by court-martial, in 1844, for "negligence," and was sentenced to two years suspension.—C. W. S.

Newton with some officers and a few of the men remained behind to further dismantle the wreck.

On the voyage home the *Rajah* was very crowded and uncomfortable, "rugs" were issued instead of hammocks and wet and stormy weather was encountered. On the forty-second day the ship arrived at Boston and the men were taken on board the receiving ship *Ohio* that afternoon. A short time after this disaster Congress appropriated $60,000 to remove the wreck and obstruction from the harbor.

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COORDINATION BEFORE AND DURING WAR.

By CAPTAIN F. K. HILL, U. S. Navy.

World politics and national policies are subjects which vitally interest every citizen of a great and growing country like the United States, but they seem to be more especially the business of our statesmen, our naval and our military officers.

It is from the point of view of the naval officer that this article is written because it seems to the author that in the higher ranks of the profession a knowledge of world politics and national policies is essential. The naval officer in peace times as well as during war is often required to act on his own initiative in national situations where errors due to lack of knowledge might produce grave results.

This article will endeavor to show that war is usually caused by a policy pursued by one nation, which policy produces antagonism in another nation or nations; that war being the result of the enforcement of a policy, must be conducted to obtain the object sought by the policy and that the treaty which ends the war must be drawn to safeguard that policy, if the nation which was enforcing it is successful, or must definitely withdraw that policy if that nation should be defeated.

Having established the truth of the above statements, a deduction will be made from them to show that a war will be properly carried on when the statesmen, who control the steps preceding and subsequent to war, work with and sustain the two military branches in harmonious plans during war, which plans are drawn to further the policies which caused the war; and further that it is necessary for the military commanders to study and broadly comprehend the policies of governments so that their plans will fit the ends to be attained.

Finally a plan will be suggested by which both the preparation for war and the conduct of war will be coordinated.

Every great country has certain policies which are adapted to the needs of that country and these policies are used as guides in the conduct of its affairs with other countries.

These policies are usually developed by the necessities of the country adopting them either to insure the territorial integrity of the country itself or else to further its interests in order that the country may derive the greatest material benefits therefrom.

The United States has at the present time two great policies: First, The Monroe Doctrine, which was originally drawn up as a defensive measure against the Holy Alliance and by which the integrity of the United States (as well as other American countries) was guaranteed against European encroachments, and, second, The Open Door policy, which is a recent development calculated to give equal opportunity to all nations in the markets now being developed in the Far East. The aim of both these policies as far as we are concerned is to enhance the power of the United States in political and commercial fields.

Another policy recently adopted is that of the exclusion of Asiatics, which policy has for its object the maintenance of a high standard of living for the citizen laborers of the United States.

The policies of a nation are almost of necessity antagonistic to the people of some other nation or nations, for they are usually formulated for the aggrandizement or protection of the nation adopting them. If a policy gives certain advantages to the citizens of a state, necessarily the citizens of some other state are placed at a disadvantage; and the friction developed by the struggle for advantage will if sufficiently great either produce war or one of the nations involved must submit its will to the other because it is less strong or not well prepared to prosecute a war.

This statement does not mean that when a country becomes prosperous others must necessarily lose in prosperity, but it does mean that the rise in power of any state results in a relative diminution in power or prestige of another state or states.

The Monroe Doctrine has frequently in the past caused considerable friction between the United States and European countries, and there was a direct threat made by the United States against England in the Venezuelan case which, if England had not

acknowledged the right of the United States, would have resulted in war. Again, the Open Door policy in the Far East has also caused considerable friction. Although at the present time (1912) most of the great powers have declared in favor of the Open Door, yet nevertheless time may develop a condition in which one or more of those countries may think it advantageous to bring forward or revive the policy of "Sphere of Influence" and do away with the Open Door. The Sphere of Influence policy gives the nation dominant in the Sphere special rights and is directly contrary to the Open Door policy. England, Germany, and Japan are great rivals of the United States in manufactures and as they all aspire to Spheres of Influence in China, it is probable that, if in the race for commercial supremacy any one of these countries finds that it is being outdistanced by a rival, then that country would endeavor by a change from the "Open Door" to the "Sphere of Influence" policy to regain the lost ground.

Japan having seized Corea and also being already partially established in Manchuria is thus geographically near to China and could pass most readily to the "Sphere of Influence" policy if she thought that thereby she might gain an advantage over her rivals in trade.

The decision as to what policies a republic is to pursue rests primarily with the people and is expressed by their agents temporarily in control of the Government. In the United States the President, Secretary of State, and the Houses of Congress (more especially the Senate) are the custodians or the directors of the policies of the people and they must decide what policies shall be carried through in spite of all opposition by foreign countries. This brings it directly to the President and his assistants to decide which policies the country is able to carry through, and in reaching this decision he must consult the naval and military authorities in order to get their expert advice as to the power of the United States to enforce its will on foreign states; in other words, to wage a successful war. It would be useless or inexpedient to put forward a policy as one for which the United States would fight if at the time its naval and military forces could not expect to cope successfully with the probable enemy. If, after consultation, the President finds that certain policies, which would bring on friction with special foreign states, are not capable of being carried through with the present naval and military forces and

yet the policies are of such vital importance to the growth of the country that they are considered essential, then the naval and military advisers should be called on to state what additional forces are necessary in order that these policies may be safeguarded from interference by foreign states. If this method were pursued the United States would never find itself in the undignified position of having advocated a certain policy and when this policy was opposed of having to withdraw it because adequate forces were not available to withstand the pressure brought to overthrow the policy. It certainly would be more dignified as a nation not to assert any policy which could not be carried out in spite of foreign pressure, rather than to proclaim much and then back down.

After the President had ascertained from his naval and military advisers what forces were necessary to enforce policies it would then be his duty to call the attention of Congress to the necessary appropriations to this end, and Congress would then make these appropriations, based on technical advice or assume the responsibility either for doing away with the policy or for the defeat of United States forces in event of war.

It seems axiomatic that Congress is unable to decide technical questions of defense or attack, but Congress may decide what policies are necessary and what policies may be abandoned and finally what forces they will provide, and having made the decision it is then incumbent upon Congress to assume the responsibility for the lack of preparation if such condition is not due to the advice of the experts. On the other hand, it is equally the duty of the naval and military advisers to assume all responsibility for bad conduct of war when adequate facilities have been given to them by Congress based on their own recommendation.

We thus see that a definite responsibility can and ought to be fixed, first, for the decision as to what the policies of the Government will be; second, for the recommendation concerning the forces necessary to carry out the policies; third, for the appropriations necessary to provide these forces; and, fourth, for the right use of these forces by the military and naval commanders after they have been provided. The people of the United States who delegate power to carry on the Government should be thoroughly informed as to the various responsibilities so that the credit for success, or odium for failure, should rest where it belongs.

At present it seems to be the popular idea that statesmen are

in control up to and including the time when the solution of difficulties between nations is impossible except by resort to arms, that after that they call in the naval and military forces to cut the Gordian knot which they have been unable to disentangle, and that the making of war has little connection with the cause of the war. *These are very false ideas.*

War being the result of policies enforced should be based on strategic plans to gain certain definite ends. For instance, if the United States had a policy of extension of territory by absorption of Canada, the war would be directed so as to gain military control of that territory, and if the war ended successfully for the United States, the treaty would probably cede such territory as was held under military control at the end of the war.

It is thus seen that the strategic objective of a war must rightly comprehend a knowledge of the policies which preceded war and contemplate the treaty which is to conclude the war.

In order to make war most successfully it is not only necessary to have properly conceived strategic plans which endeavor to carry out policies, but these policies must be based on the moral convictions of the people that not only are the results of the policies beneficial to the country but also that they are ethically correct. The moral force of the nation must be behind the policy and this moral force must be developed in the people so that every ounce of the strength of the nation will be exerted throughout the war. All wars gather strength from the intensity with which the people enter into the spirit of upholding the policy adopted. A war waged in a lukewarm spirit is worse than useless, and it would be better not to enter into war unless it is known that the fight will have the backing of the people to the bitter end.

A most striking illustration of a policy carried forward aggressively and with the backing of the people is that of Germany in her industrial expansion at the present time. She has put her hand to the plough and has systematically developed her navy, merchant marine and industries to the end that nothing shall impede her progress in this direction. The people are imbued with the spirit of the thing or otherwise it would never have been possible to impose the taxes to raise the money for carrying out those projects which are the *adjuncts of the main object.*

So we see that policies make war; that war is conducted to further policies, and that treaties carry forward these policies when war decides in their favor.

It has been mentioned above that the President in reaching a decision as to which policies the country is able to carry through must consult the Naval and Military authorities. At this time in order to make a proper decision these experts must, having due regard to a policy to be enforced, lay out in conjunction plans of campaign. This work is done by the General Board of the Navy and the Army War College and their separate deductions are harmonized by the Joint Board. It is to be regretted that in the development of these plans an authoritative representative (a State Department Official) is not assigned to duty on the Joint Board. The harmony of the essential parts of the military plans will follow when the Navy and Army work more closely together, but the harmony of the full campaign *to the end to be attained* will be greater if Executive representation is combined with the Military in the drawing up of the strategic plans.

Since these naval and military experts must base their campaigns on strategic objectives to carry out the policy, they necessarily must makes studies of foreign policies and have intimate knowledge of the existing relations of their home country to all foreign countries. On this knowledge the campaign must be founded and during the progress of the war no action must be taken which is opposed to the existing diplomatic conditions. Hence the commanders of both branches must be conversant with international conditions as well as military plans.

Admiral Mahan says, in regard to the commander-in-chief, as follows:

> While a government is responsible for its choice of the chief naval commander, it must depend upon him for the enforcement of discipline and for the choice of measures at once practicable and adequate to compass the ends of the war. Upon him more than upon any other must fall the responsibility of failure; for he knows or should know better than the government, what the fleet can be made to do, what the state of discipline really is, and what his own capacity to carry out the one and support the other. Only through him can the government act. When it disregards or over-rides without displacing him mischief ensues; but the correlative of the generous, confident, and hearty support it owes him are on his part unceasing intense effort, or resignation.

No better exposition from a purely naval point of view could be given than the above, but it is respectfully submitted that to carry out what is required will necessitate a complete understanding of diplomatic conditions by the commander-in-chief, which conditions must be the basis of his strategic plans.

The plans, therefore, should be developed after discussion between representatives of the State, War and Navy Departments. The first understanding the conditions and the latter two the methods of carrying out the conditions. The war following the plans should ever have in mind the conditions which formed the basis of the plans. The plans may be modified or adjusted but the conditions will always remain fixed.

We see, therefore, in the first place, that under all circumstances war is to be regarded not as an independent thing, but as a political instrument; and it is only by taking this point of view that we can avoid finding ourselves in opposition to all military history. This is the only means of unlocking the great book and making it intelligible. Secondly, this view shows us how wars must differ in character according to the nature of the motives and circumstances from which they proceed.

Now, the first, the grandest, and most decisive act of judgment which the statesman and general exercise is rightly to understand in this respect the war in which he engaged, not to take it for something, or to wish to make of it something, which by the nature of its relations it is impossible for it to be. This is, therefore, the first, the most comprehensive, of all strategical questions. (Clausewitz.)

CONCLUSIONS.

War is not independent of political considerations, but must be outlined and carried on with due regard to these considerations. That to properly outline the war the three branches of the Government (State, War and Navy Departments) should act in conjunction, and that peace preparation in anticipation of war should be the joint action of Congress, the War and the Navy Departments.

Finally both the peace preparations and war will best be carried out by a National Board for Defense comprised of units representing both branches of Congress and the Departments of State, War and Navy.

The following is suggested as the composition of the National Board for Defense:

Secretary of State.
Secretary of War.
Secretary of the Navy.
Chairman of Senate and House Military Committees.
Chairman of Senate and House Naval Committees.
Chief of Staff, Army.

President of Army War College.
Naval Aid of Operations.
President of Naval War College.
One Permanent Secretary.
Civilian under State Department.

For the information of this board it is necessary to have as its head the Secretary of State, who knows about the diplomatic relations which may precipitate war; it is necessary to have the legislative members so that they may decide on the policies to be carried out and the expenditures required to prepare for war, and it is necessary to have the military branches which will furnish technical information as to preparation for war and from the discussion of the board will understand the policies to be enforced in the prosecution of war, and so draw the strategic plans that the object of the war may most fully be accomplished.

EDITOR'S NOTE.—The House Naval Committee during week ending April 27, 1912, favorably reported the bill H. R. 1309, establishing the Council of National Defense as is herein proposed, except that the chairmen of the Senate and House Committees on Appropiations and on Foreign Relations are added to the council. The Naval Aid of Operations is not designated as such, but as an officer of the navy not below the rank of captain.

COUNCIL OF NATIONAL DEFENSE AS CONSTITUTED BY THE FOLLOWING NATIONS:

FRANCE.

PARIS, April 3, 1906.

ARTICLE 1. A supreme board of national defense is instituted for the examination of all questions requiring the cooperation of two or more ministerial departments.

ART. 5. The supreme board of national defense shall be composed of: The president of the board of ministers, presiding; the minister of foreign affairs; the minister of finance; the minister of war; the minster of marine; the minister for the colonies.

ART. 6. The chief of staff of the army, the chief of staff of the navy, and the president of the consultative committee for colonial defense shall be present at meetings of the supreme board with deliberative voice.

RUSSIA.

(This and a great general staff were created by the Emperor of Russia as a result of the experience of the Russo-Japanese War.)

The board of national defense is charged with the study of questions which relate to the security of the Empire. It acts under the direct orders

of the Emperor, and is made up of a president and six permanent members —all named by the Emperor—but has also a certain number of other members, some on account of the office which they hold, as the ministers of war and of the navy, the chief of the general staff, the chief of the great general staff of the navy, and the inspectors of the army, and others because of their personal knowledge or because of the needs of the service as, for example, ministers, commanders of army corps, etc.

The board of national defense has the following duties:

(a) Study of general measures so that a fixed plan may be determined upon by the ministers of war and of the navy in order to assure the development of the military power of the Empire in conformity to the political ends which it is desired to accomplish.

(b) To watch that these measures are carried out as soon as they have the approval of the Emperor.

(c) Study of propositions emanating from the military ministers and conforming them to order that all resources may be employed in time of war and unification and direction of all preliminary measures.

(d) Study of modifications which it is desirable to make in the plans of the two military ministers.

(e) Study and solution of the questions of the fitness of the different branches of the administration and the differences which exist in them from the standpoint of national defense.

The board of national defense has no executive power, but is limited to recommendations to the Emperor. The execution of measures which receive the approval of the Emperor is in charge of the minister of war. The president has direct communication with the Emperor, and speaks as his mouthpiece when he presides in the board. Said president forms a part by virtue of his office of the imperial council and of the council of ministers. He has the right to ask from the various ministers anything which can contribute to the work of the board, and receives from the minister of war, of the navy, and of foreign affairs information relating to the national defense. All the deliberations and actions of the board are considered as state secrets. (Revista Cientifico-Militar y Biblioteca Militar, 25 Septiembre, 1905.)

ITALY.

By a decree of the 16th of July, 1897, the Supreme Mixed Commission for the Defense of the Empire was organized. This is charged with the duty of giving advice on all important questions concerning the defense of Italy. The Duke of Genoa is president; the members are: the admiral president of the superior council of the navy, the generals designated to command the various armies in case of war, the admirals designated to command the fleets, and the chief of the general staff of the army and of the navy. The generals, the commanders of army corps, the inspectors general and admirals, when it appears that their presence will be useful, may be invited to attend the meetings of the commission for consultation only. (L'Etat Militaire des Principales Puissances Etrangeres en 1902, Lauth.)

SPAIN.

Spain has a consultative board for war which is concerned with the large questions in reference to preparation for war, etc. The organization and the composition of this board are regulated by decisions made in the council of ministers. (L'Etat Militaire des Principales Puissances Etrangeres en 1902, Lauth.)

JAPAN.

The Japanese have what is known as the "Supreme Military Council," composed of the Minister of Foreign Affairs, representing the diplomatic side, four general officers and two flag officers. This was created in 1898.

The Supreme Council of War, which was created in 1904, is an addition to the "Supreme Military Council." This Supreme Council of War may be regarded as the Emperor's advisers and staff officers on all important matters pertaining to war. It consists of the personnel of the "Supreme Military Council," the Ministers of War and of the Navy, the Chiefs of the General Staff of the Army and the Naval Staff Board. (Taken from Japan Year Book, 1907.)

GREAT BRITAIN.

Matters of naval and military policy are considered by a committee of the cabinet called the "Defense Committee." It is presided over by the Prime Minister and always includes the Secretary of State for War, the first Lord of the Admiralty, the Secretary of State for Foreign Affairs, and for India, the Chancellor of the Exchecquer, the Chief of the General Staff, the Director of Naval Intelligence, the first *Sea* Lord of the Admiralty, and the Director of Naval Operations. Other naval and military officers of rank and experience are asked to attend from time to time.

AUSTRO-HUNGARY.

The War Ministry includes both the army and the navy. The War Minister, always a general officer of high rank, is the head of the Imperial War Office, and under him are the Austrian and Hungarian Defense Ministers. The navy of Austria, being mainly a coast defensive force, is administered by the Naval Department of the Ministry of War. Common to the two states of Austro-Hungary are Foreign Affairs and Military and Naval Affairs.

The Council of National Defense consists of the Emperor, the Ministry of Foreign Affairs and the Ministry of War. The Austrian General Staff cooperates with the Naval Department of the War Ministry in the formulation of all war plans. These plans are then laid before the Council of National Defense, which either accepts them or returns them with such suggestions as may be deemed advisable from a diplomatic point of view. In this way all matters relating to war and preparations for war are solved, the system in vogue being an ideal one. The nucleus of a plan is evolved by the Council of National Defense; this is then laid before the general staff, which in turn works out the military solution, returns it, and thus, between the two bodies, a solution of all plans is finally arrived at which, once accepted, is adhered to.

EXTRACTS FROM VARIOUS AUTHORITIES BEARING ON THE SUBJECT OF THE PRECEDING ARTICLE.

VON DER GOLTZ.

CONDUCT OF WAR.

"Upon policy the whole condition, the feeling, the constitution, and the moral and physical affairs of a state depend; and upon these depend, again, the waging of war.

"Policy, again, regulates the relations not merely of those states immediately concerned, but also those of such as are indirectly interested in the final issue. Their favor or disfavor may be of very great significance, impeding the course of events, or promoting them. Politics, again, as a rule, determine the moment for the outbreak of hostilities, upon the happy choice of which much depends. They, in short, create the general situation, in which the state enters into the struggle, and this will be of material influence upon the decisions and attitude of the commander-in-chief, and even upon the general esprit of the army.

"In the face of the great weight of warlike events in our modern times, politics retreat more and more into the background, as soon as the cannon thunder.

"Politics regain their influence only so soon as it is felt that, in the case of one of the belligerents, the desire for peace begins to prevail over his desire for continuing the struggle, and that all hope of the success of his arms is dying away. It will then be for politics to bring about a rapprochment under which both parties can arrive at an understanding respecting the end of the struggle. The influence of third powers, too, must not be lost sight of. It frequently determines how far the victor may proceed in his demands, and how far and to what extent the vanquished must give way.

"In the last stages of a war, when the issue and decision by arms is no longer doubtful, the military element naturally makes way more and more for the political. The effect of politics frequently makes itself immediately felt in the decisions of the commander-in-chief. Political considerations may, under certain circumstances, bring about a battle which, although no longer necessary from a purely military point of view, is regarded on the one side as a last attempt, and on the other as final means of coercion. One of the belligerents, perchance, does not desire this final decision for its own sake. A weak government requires it in order to explain to its own people the necessity for peace, even when it had no longer hopes of victory. What marvelous fruits the interference of politics at the end of a war may bring forth, was seen in 1871, when an armistice was concluded, whilst on another part of the theater of war the struggle was still being carried on; just like two fencers who have been separated before their courage has cooled down.

"War serves politics both before and after. War waged only for annihilation and destruction is in these days inconceivable. An end and aim that is of permanent value to the state, be it only a question of ascendancy, must be existent; and this can only arise from political considerations.

"The object of a war is of such importance and will be of such lasting

effect upon the exertions which nations make to attain it, that we ought, almost on that account alone, to place policy first among conditions of success. Now, as we have here pointed out, many motives are also attendant, and thus we may without hesitation lay down a maxim that without a good policy a successful war is not probable.

"War will, on that account, be in no way degraded in importance nor restricted in its independence, if only the commander-in-chief and the leading statesmen are both clear that war, under all circumstances, serves politics best by completely defeating the enemy. By attention paid to this maxim, not only is the greatest liberty assured to politics, but, at the same time, the widest scope is allowed in the employment of the combative forces.

"How heartily politics and war ought to co-operate is manifest."

CLAUSEWITZ.

ON WAR.

"Here the question which we had laid aside forces itself again into consideration, viz.: the political object of the war. The law of the extreme, the view to disarm the adversary, to overthrow him, has hitherto to a certain extent usurped the place of this end or object. Just as this law loses its force, the political object must again come forward. If the whole consideration is a calculation of probability based on definite persons and relations, then the political object, being the original motive, must be an essential factor in the product.

"Thus, therefore, the political object, as the original motive of the war, will be the standard for determining both the aim of the military force and also the amount of effort to be made.

"Now, if we reflect that war has its root in a political object, then naturally this original motive which called it into existence should also continue the first and highest consideration in its conduct. Still, the political object is no despotic law giver on that account; it must accommodate itself to the nature of the means, and though changes in these means may involve modification in the political objective, the latter always retains a prior right to consideration. Policy, therefore, is interwoven with the whole action of war, and must exercise a continuous influence upon it, as far as the nature of the forces liberated by it will permit.

"We see, therefore, that war is not merely a political act, but also a real political instrument, a continuation of political commerce, a carrying out of the same by other means. All beyond this which is strictly peculiar to war relates merely to the peculiar nature of the means which it uses. That the tendencies and views of policy shall not be incompatible with these means, the Art of War in general and the Commander in each particular case may demand and this claim is truly not a trifling one. But however powerfully this may re-act on political views in particular cases, still it must always be regarded as only a modification of them; for the political view is the object, War is the means, and the means must always include the object in our conception.

"We see, therefore, in the first place, that under all circumstances War is to be regarded not as an independent thing, but as a political instrument;

and it is only by taking this point of view that we can avoid finding ourselves in opposition to all military history. This is the only means of unlocking the great book and making it intelligible. Secondly, this view shows us how wars must differ in character according to the nature of the motives and circumstances from which they proceed.

"Now, the first, the grandest, and most decisive act of judgment which the statesman and general exercise is rightly to understand in this respect the war in which he engages, not to take it for something, or to wish to make of it something, which by the nature of its relations it is impossible for it to be. This is, therefore, the first, the most comprehensive, of all strategical questions.

"War is, therefore, not only chameleon-like in character, because it changes its color in some degree in each particular case, but it is also, as a whole, in relation to the predominant tendencies which are in it, a wonderful trinity, composed of the original violence of its elements, hatred and animosity, which may be looked upon as blind instinct; of the play of probabilities and chance, which make it a free activity of the soul; and of the subordinate nature of a political instrument, by which it belongs purely to the reason.

"The first of these three phases concerns more the people; the second, more the General and his Army; the third, more the government. The passions which break forth in war must already have a latent existence in the peoples. The range which the display of courage and talents shall get in the realm of probabilities and of chance depends on the particular characteristics of the general and his army, but the political objects belong to the government alone."

JOMINI.

THE ART OF WAR.

"The art of war, as generally considered, consists of five purely military branches: viz., Strategy, Grand Tactics, Logistics, Engineering, and Tactics. A sixth and essential branch, hitherto unrecognized, might be termed Diplomacy in its Relation to War. Although this branch is more naturally and intimately connected with the profession of a statesman than with that of a soldier, it cannot be denied that if it be useless to a subordinate general, it is indispensable to every general commanding an army; it enters into all the combinations which may lead to a war, and has a connection with the various operations to be undertaken in this war; and, in this view, it should have a place in a work like this.

"To recapitulate, the art of war consists of six distinct parts:

"1. Statesmanship in its relation to war.

"2. Strategy, or the art of properly directing masses upon the theater of war, either for defense or for invasion.

"3. Grand tactics.

"4. Logistics, or the art of moving armies.

"5. Engineering—the attack and defense of fortifications.

"6. Minor tactics."

STATESMANSHIP IN ITS RELATION TO WAR.

"Under this head are included those considerations from which a statesman concludes whether a war is proper, opportune, or indispensable, and determines the various operations necessary to attain the object of the war.

"War is always to be conducted according to the great principles of the art; but great discretion must be exercised in the nature of the operations to be undertaken, which should depend upon the circumstances of the case.

"To these different combinations, which belong more or less to statesmanship, may be added others which relate solely to the management of armies. The name Military Policy is given to them; for they belong exclusively neither to diplomacy nor to strategy, but are still of the highest importance in the plans both of a statesman and a general."

SPENSER WILKINSON.

THE BRAIN OF AN ARMY.

"The Emperor unites the supreme military with the supreme political control. This combination is intended to secure the first of all conditions for success in war, harmony between the political and the military direction. It is impossible to overrate the importance of accord between strategy and policy. The soldier is at all times the servant of the statesman; a relationship the loyal recognition of which implies that the soldier abstains from prescribing ends to the statesman, the statesman from interfering with the soldier in the choice of means. An exhaustive discussion of the relations between the army and the government—that is, between war and policy—lies beyond the scope of this work. But it is relevant to say that the successful conduct of a state in war as in peace, depends very largely upon the clearness with which the sovereign power conceives its political ends, and the resolution with which they are pursued. No perfection of the military organization can compensate for the failure of the statesman to frame a clear conception of his aims, or for his timidity or hesitation in the effort to attain them.

COL. G. F. R. HENDERSON, C. B.

THE SCIENCE OF WAR.

"It is hardly necessary to observe that no civilian minister, however deeply he might have studied the art of war, could be expected to solve for himself the strategic problems which come before him. In default of practical knowledge, it would be as impossible for him to decide where garrisons should be stationed, what fortifications were necessary, what roads should be constructed, or how the lines of communications should be projected, as to frame a plan of campaign for the invasion of a hostile state. His foresight, his prevision of the accidents inevitable in war, would necessarily be far inferior to those of men who had spent their lives in applying strategical principles to concrete cases; and it is exceedingly unlikely that he would be as prolific of strategical expedients as those familiar with their employment. Nevertheless, although he would be more or less guided by expert advice, and although he might be aware that the attempt

to control military operations, even so far as regards the preliminaries of a campaign, is a most dangerous proceeding, yet a knowledge of war could hardly fail to serve him in good stead. Arnold, in his 'Lectures on Modern History,' puts the matter clearly: 'There must be a point up to which an unprofessional judgment on a professional subject may not only be competent, but of high authority, although beyond that point it cannot venture without presumption and folly. The distinction seems to lie originally in the difference between the power of doing a thing and that of perceiving whether it is well done or not. "He who lives in the house," says Aristotle, "is a better judge of its being a good or bad one than the builder of it. He can tell not only whether the house is good or bad, but wherein its defects consist; he can say to the builder, 'This chimney smokes, or has a bad draught'; or 'This arrangement of the rooms is inconvenient,' and yet he may be quite unable to cure the chimney, or to draw out a plan for his rooms which should suit him better. Nay, sometimes he can even see where the fault is which has caused the mischief, and yet he may not practically know how to remedy it." Following up this principle, it would appear that what we understand least in the profession of another is the detail of his practice. We may appreciate his object, we may see where he has missed it, or where he is pursuing it ill, nay, may understand generally the method of setting about it, but we fail in the minute details. . . . But in proportion as we recede from those details to more general points, first, as to what is generally called strategy, that is to say, the directing the movements of an army with a view to the accomplishment of the object of the campaign, in that proportion general knowledge and power of mind come into play, and an unprofessional person may, without blame, speak or write on military subjects, and may judge of them sufficiently.'

"Applying this wise rule to statecraft, the point where civilian control of military operations becomes presumptuous, as well as the extent of that control, may be easily defined. In the first place, to frame a sound strategical plan, whether for defense or invasion, requires not only an intimate acquaintance with innumerable details of which only a professional soldier can really judge, such as methods of supply and transport, the use of fortifications, the effects of climate, the maintenance of the lines of communication, the value of positions, the management of marches, the morale, armament, organization, tactics, and resources of the opposing forces, but an intimate acquaintance with the principles and stratagems of war. It is here that the amateur strategist fails. He may have read enough to give him a good knowledge of principles, but he has no knowledge of the practical difficulties of war, and his criticism, as a general rule, is consequently of little value. All war is simple, but the simple is most difficult, and how difficult only those who have made it, who have witnessed with their own eyes the turmoil, the confusion, the friction, which, even in the best armies, attend the most ordinary operation, are in a position to understand. Even a theoretical acquaintance, derived from historical study of the practical difficulties, is insufficient. Unless he who prepares a strategical plan has before his mind's eye a clear picture of all military opera-

tions, of marching, quartering, supply, entraining, and detraining, embarkation, and debarkation, and a personal knowledge of the difficulties which attend on war, his work will be of little value. It is essential, too, that he should have a thorough knowledge of both officers and men, of the peculiar characteristics of the army, and of the system on which it works, of its strong points and its weak. A German, suddenly placed in command of British soldiers, would be much at sea, and *vice versa*. Every army has an individuality of its own. It is a living organism of a very sensitive temper, and it can neither be properly controlled nor efficiently directed except by those who are in full sympathy with its every impulse.

"It would appear, then, that while a statesman may be competent to appreciate the general principles of the projects of operations laid before him, he should never attempt to frame a project for himself. Still less, when once he has approved of a plan of campaign, should he attempt to limit the number of troops to be employed, or to assign the position of the necessary detachments. Nevertheless, a knowledge of war may still be exceedingly useful to him. A minister of war cannot divest himself of his responsibility for the conduct of military operations. In the first place, he is directly responsible for plans of campaign to meet every possible contingency being worked out in time of peace. In the second place, he is directly responsible for the advice on which he acts being the best procurable. It is essential, therefore, that he should be capable of forming an independent opinion on the merits of the military projects which may be submitted to him, and also on the merits of those who have to execute them. Pitt knew enough of war and men to select Wolfe for the command in Canada. Canning and Castlereagh, in spite of the opposition of the king, sent Wellington, one of the youngest of the lieutenant-generals, to hold Portugal against the French. The French Directory had sufficient sense to accept Napoleon's project for the campaign of Italy in 1796. In the third place, strategy cannot move altogether untrammelled by politics and finance.

"But political and financial considerations may not present themselves in quite the same light to the soldier as to the statesman, and the latter is bound to make certain that they have received due attention? If, however, modifications are necessary, they should be made before the plan of campaign is finally approved; and in any case the purely military considerations should be most carefully weighed. It should be remembered that an unfavorable political situation is best redeemed by a decisive victory, while a reverse will do more to shake confidence in the government than even the temporary surrender of some portion of the national domains. 'Be sure before striking' and 'reculer pour mieux sauter' are both admirable maxims; but their practical application requires a thorough appreciation of the true principles of war, and a very large degree of moral courage, both in the soldier who suggests and in the statesman who approves. If, however, the soldier and the statesman are supported by an enlightened public, sufficiently acquainted with war to realize that patience is to be preferred to precipitation; that retreat, though inglorious, is not necessarily humiliating, their task is very considerably lightened.

"Nothing is more significant than a comparison between the Paris press in 1870 and the Confederate press in 1864. In the one case, even after the disastrous results of the first encounters had proved the superior strength and readiness of the enemy, the French people, with all the heat of presumptuous ignorance, cried out for more battles, for an immediate offensive, for a desperate defense of the frontier provinces. So fierce was their clamor that both the generals and the government hesitated, until it was too late, to advise the retreat of Bazaine's army; and, when that army had been cut off at Metz, the pressure of public opinion was so great that the last reserve of France was despatched to Sedan on one of the maddest enterprises ever undertaken by a civilized state. In 1864, on the other hand, while Lee in Virginia and Johnston in the West were retreating from position to position, and the huge hosts of the Union were gradually converging on the very heart of the Confederacy, the Southern press, aware that every backward step made the Federal task more difficult, had nothing but praise for the caution which controlled the movements of their armies. But the Southern press, in three crowded years of conflict, had learned something of war.

"In 1866 and 1870 the German press was so carefully muzzled that, even had there been occasion, it could have done nothing to prejudice public opinion. Thus both the sovereign and the generals were backed by the popular support they so richly merited; but, it may be remarked, the relations between the army and the government were characterized by a harmony which has been seldom seen. The old king, in his duel capacity as head of the state and commander-in-chief, had the last word to say, not only in the selection of the superior officers, but in approving every important operation. With an adviser like Moltke at his elbow, it might appear that these were mere matters of form. Moltke, however, assures us that the king was by no means a figurehead. Although most careful not to assert his authority in a way that would embarrass his chief of staff, and always ready to yield his own judgment to sound reasons, he expressed, nevertheless, a perfectly independent opinion on every proposal placed before him, and on very many occasions made most useful suggestions. At the same time, while systematically refraining from all interference after operations had begun, he never permitted military considerations to override the demands of policy."

REAR-ADMIRAL MAHAN.

LECTURE DELIVERED AT NAVAL WAR COLLEGE, 1910.

In concluding, I wish to draw your attention pointedly to one remark of Corbett's. I expect to use from him several illustrative incidents in due place; but the remark I here quote bears upon a necessary element of naval strategic thought, which used to be not only ignored, but actually discredited and decried. I mean the appreciation of political conditions as an essential factor in all military plans. I will cite an instance, immediately under our eyes. When Germany shall have finished the ships contemplated in the naval program which she has formally adopted, she will have a navy much superior to that of the United States, unless we change our present

rate of building, and also provide more extensive plants. Where then will be the Monroe Doctrine? and where the security of the Panama Canal? The enforcement of both these depends upon the fleet.

The question, if merely one of military force, would be simple; the superior fleet dominates, if the margin of superiority be sufficient. It is the question of political relations which introduces perplexing factors; and the military adviser of a government is not competent to his task, unless, by knowledge of conditions, and practice in weighing them, he can fairly estimate how far inferior numbers may be reinforced by the pressure which other considerations may bring to bear on a possible enemy. Every naval officer should order his study, and his attention to contemporary events, abroad and at home, by the reflection that he may some day be on a general staff, and in any case may beneficially affect events by his correct judgment of world-wide conditions.

I have just stated a principle, viz., the necessity of including political—international—conditions in military projects. An illustration, the complement of the principle, is the contemporary historical relations of Germany and of the United States to other nations. For instance, there is the solidarity of action between Germany and Austria, just shown by the pressure of Germany upon Russia to ignore Great Britain and France, and to recognize the Austrian annexation of Bosnia and Herzegovina. These incidents are not six months old. I cannot, of course, enter now into an elaborate analysis of all that this German action means, but I can indicate the, to us, important question involved, which is this: How far do Germany's relations with other European states permit her embarking her fleet in a trans-Atlantic adventure? If we had no fleet doubtless she could afford to do so. If we have nine ships to her ten she probably could not so afford; because the fight we could put up, whatever the issue, would leave her without a navy to confront Europe. On the other hand, should our Pacific coast citizens precipitate us into a war, or even into seriously strained relations, with Japan, that pressure upon us would add to the force of the German fleet. In our long contention with Great Britain, based on the Monroe Doctrine, we made continuous progress up to the Hay-Pauncefote Treaty of a half dozen years ago, which registered the final triumph of the Monroe Doctrine. During all this period our navy was hopelessly inferior to the British, sometimes ludicrously so, yet we won out. Why did we? and are we in similarly good condition for a possible contention with the new sea power? Where ought Great Britain to stand, in case we have trouble with Germany? and where ought we to stand, in the reverse case?

Corbett's remark is, that in the Seven Years' War, the strength of the British action lay in the fact that *one* great man, the first Pitt, controlled the naval, the military, *and* the diplomatic action. The several conditions were thus weighed, and were harmonized into a common action, to which each contributed its utmost influence in mutual support. The desirability of the result must fix our eyes upon the fact that, in our country at least, it will never be attained through one man, but only by the cooperation of several. These several will be statesmen, military men, and naval men; and, in order that their cooperation may be adequate, each must understand

the conditions by which the others are controlled. The often failure of conjoint military and naval operations has been due less to mean jealousy than to lack of such mutual understandings; and for a due grasp of preparation for war, and for planning war, military men of both services need to be imbued with knowledge of international relations. Those relations do affect the amount of force available in various quarters, by the several opponents. Thus Darrieus says correctly: "Every naval project which takes account neither of the foreign relations of a great nation, nor of the material limit fixed by its resources, rests upon a weak and unstable base. Foreign policy and strategy are bound together by an indestructible link;" and in this connection he quotes the German, Von der Goltze: "Whoever writes on strategy and tactics ought not in his theories to neglect the point of view of his own people. He should give us a national strategy, a national tactics." Now the Monroe Doctrine is a point of view of the American people; and no scheme of strategy—such as the numbers and constitution of the fleet—is sound if it neglect this consideration. The remark applies to statesmen as well as to officers.

My last word to you, then, in these preliminary remarks, is to master, and keep track of, the great current events in history contemporary with yourself. Appreciate their meaning. Your own profession, on its military side, calls of course for your first and closest attention; but you all will have time enough to read military history, appreciating its teachings, and you can also keep abreast of international relations, to such an extent that when you reach positions of prime responsibility, your glance, your coup d'oeil, to repeat the French idiom, will quickly take in the whole picture of your country's interests in any emergency, whether that be pressing or remote. To repeat Nelson's phrase, you will be no novice; and you will not, because, you, in your career, as he in his, will have been continually applying the judgment you are now called specially to exercise. That you may more effectually do this, banish from your mind all concern about questions interior to the country; questions financial, sociological, economical, or what not. The sphere of the navy is international solely; and it is this which allies it so closely to that of the statesman. Be yourselves statesmen as well as seamen. The biography and history of our profession will give you glorious names who have been both. I trust the future may show many such among the sons of this college.

DARRIEUS.

WAR ON THE SEA.

General Policy of Nations; Its Close Connection with Strategy.

It is chiefly in taking up this chapter that I feel all the difficulties of my task. In the short space at my disposal, I ought to pass in review all the elements which make up the foreign policy of a great nation, to show how it acts as the motive and regulator of strategy. This magnificent study, too vast for our limited program, would moreover exceed my ability. And yet it is indispensable for me to show, were it only in a brief statement, the intimate connection which makes military conceptions the natural consequence of political conceptions. There is no study of strategy possible

without that. It has become a common saying that: "A nation must have the fleet which corresponds to its policy." To understand the full value of this expression, it suffices to imagine the two extreme possible conclusions of the policy of a given nation: Conflict with England or with the Swiss Confederation. And at once it is clearly apparent, not only that the conduct of the war evidently cannot be the same in the one as in the other case, but furthermore that, between these two limiting cases of an exclusively naval power and another with land forces only, there exists an infinity of mixed solutions in which the relative value of the naval force is more or less great in comparison with the total military force.

The point of departure being thus clearly defined, it results therefrom that the future conduct of the operations of war, depending necessarily upon the composition of the adversary's forces, demands prior knowledge of the political objectives. There is no possible strategy, using the expression in its broadest sense, that is in its relation with preparation for war during peace times as well as in its connection with the direction given to actual operations, unless at the very beginning the probable adversary or adversaries are known. Even more, it is usually from the prior political action that military strategy derives its fundamental premises, knowledge of the enemy, of his weak points as well as of the resources at his disposal, of his moral state as well as of his material situation; in short all the information the utilization of which is the most valuable element in success. Finally, it is through politics alone that the military art can emerge from pure abstraction, wholly speculative, to solve concrete cases; it is politics which makes it fruitful.

The very foundations of the military structure rest then upon the precise designation of the nations with which causes of conflict are permanent or even liable to occur. And it is because the study of strategy would be absolutely sterile without this essential datum that I have undertaken to write this chapter.

Commander-in-Chief Not to be Interfered With During War.

We have there seen an admirable chief, full of energy and of wise resolution, having a very clear sense of the fundamental rules of the conduct of war and capable, surely, as he has proved himself, of accomplishing great deeds, if the blundering control of an authority exercised from thousands of miles away had not neutralized these incomparable qualities. Quite like Tourville before him, Courbet suffered from too heavy fetters placed by the government on his military actions.

In striking contrast to this is what will happen ten years later in the same theater. We shall not find then, at the head of the Japanese fleets, admirals of such exceptional worth as to deserve immortality, but on the other hand we shall see a staff already conscious of the impossibility of military improvisations, knowing what it wishes and with a firm will to attain to it, having prepared a plan of operations in conformity with sane principles and carrying it out to the end without weakness. We had "the man," but we neglected preparations for war, as well as war itself; in the contest between China and Japan, the conquerors did not have "the man," but they know how to prepare methodically for war and to carry on war. This

was an experimental proof that the system to which von Moltke owed his successes in 1870 is as excellent on the sea as on shore.

One other observation is necessary; there are no profitable operations possible in a war the details of which the political power pretends to direct, when the distance of the field of action forbids its determining their relative importance and following their progress.

We have already had occasion to exhibit the productive freedom of action which Nelson of good rights enjoyed, the elasticity of the general orders given to him, wholly contained in the brief and clear formula; to win command of the Mediterranean, which permitted him to follow the enemy's fleet even to the Antilles.

Suffren, he also felt the full value of military independence when he wrote the minister, de Castries: "The king can be well served in these far-off countries only when those in command have great powers and the courage to use them."

Moreover, our illustrious seaman had found a man capable of understanding him in this minister who wrote to him: "The king has announced to you in your instructions, Sir, that all courageous acts which his generals may do, even though they fail of the success which their boldness deserves, will be none the less honored of him, and that inaction is the only thing with which he will be displeased."

I have already affirmed under too many circumstances the necessity of building everything upon a system of definite responsibilities for anyone to suppose that I am defending the delegation of powers. It belongs to the national authorities alone to give the initial impulse, to establish what may be called the program of future hostilities, but if one makes war, of his own accord or because he is forced to, it matters not which, he must know how to make it; once the war has begun, its direction belongs to the military chief. Every other method leads straight to defeat, and if all the conquests of modern progress in the matter of rapidity of communications are to have for a consequence restraint of the indispensable initiative of the supreme commander in the field, all the benefits which they confer will not be sufficient to make up for their evil effects.

That is why I could not let slip the chance of expressing myself frankly on this subject. If there be need of supporting the examples of Suffren and Nelson, we have the great authority of Napoleon, the master of the subject. Treating, in his Memoirs, of the duties of generals, he expresses himself as follows:

"A general-in-chief is not relieved of responsibility by an order from a minister or a prince far from the field of operations and knowing badly or not knowing at all the last state of affairs: (1) Every general-in-chief who undertakes to execute a plan which he thinks bad or injurious is criminal; he ought to make representations, to insist upon a change, finally to resign rather than be the instrument of the ruin of his own people; (2) every general-in-chief, who, in consequence of orders from a superior, delivers battle with a certainty of losing it, is equally criminal; (3) a general-in-chief is the first officer of the military hierarchy. The minister, the prince give directions to which he must conform in his soul and conscience; but these directions are never military orders and do not exact a blind obedi-

ence; (4) even a military order is to be blindly obeyed only when it is given by a superior who, being on the spot at the moment of giving it, knows the state of affairs. . . ."

It seems to me well to give these quotations, not only because, with due regard for the proportions of course, they apply to the campaign we have just been considering, but also because they condemn the unfortunate natural tendency of the central authority, in almost all contemporary wars, in all countries, to meddle with the practical conduct of operations. I am inclined to think, for my part, that the repeated defeats of General Kuropatkin, on the plains of Manchuria, had no other original cause.

CAPTAIN BELLATI DI SAINT PIERRE, ITALIAN NAVY.

"NAUTICAE RES."

When, owing to the unpreparedness of the naval forces, a commander-in-chief fails in his designs, there is a tendency to make of him a scape-goat. There are thus forgotten the duties incumbent upon governments, and through them upon the nation, in that they failed to give him the necessary and sufficient means for the object that it was determined to secure. The authority of the commander-in-chief is thus halved from the very beginning. Torrington had the scorn of his own country on account of the defeat at Beachy Head, but it would be unjust not to remember that a year previously he resigned as head of the administration, because the government refused his requests to reenforce the fleet which he believed unequal to confronting the events that were preparing. In fact he was absolved by the court martial.

We have already said that it is certainly not advisable for a commander-in-chief to disobey the orders that he receives; but if the situation on the spot makes it evident that obedience may lead to a failure or to a grave error, it is obligatory upon the commander-in-chief to go ahead with his plans without executing the orders that he receives, assuming the entire responsibility for his acts. Such characters are difficult to find, and for this reason—we cannot too much insist upon it—commanders-in-chief must be men of conspicuous moral and military virtue, and of exceptional character. It must be the study of governments to know how to single them out wherever they may be found. In 1866 the man designated should have been Galli della Mantica (allowed to go into anticipated and voluntary retirement) giving no attention to seniority, even as the English selected Nelson; the Japanese, Togo; the Austrians, Tegethoff, Trafalgar, Tsushima, Lissa; what results!

In every war plan the understanding between the army and the navy must be provided for long beforehand, and their respective tasks exactly defined. For this reason, with word and pen, we have always maintained that this understanding should be full and complete.

We should exceed the modest limits that we have imposed upon ourselves in this paper, if we should set forth our ideas in this connection. Let it suffice to say that we maintain the necessity of constituting a permanent Board of Defense, with the express purpose of getting together the energies and the intelligence of the military and naval authorities for the study of

coordinated preparation for war on land and on sea. We content ourselves with referring the readers who desire to go deeply into the question to Lord Esher's work, "National Strategy."

The lack of full and entire understanding between them was the reason for the want of unity between the military and naval authorities at Port Arthur, and the principal cause of the incomplete defense of that fortress. Such a state of things is the cause of interminable delays that redound to the detriment of the defense of the country.

War must have a single direction, and, in the particular case under consideration, a maritime fortress must be under a single command. Let it be naval or military as may be desired this is a matter of no importance, and we do not wish to consider it here; the essential thing is that a single authority shall command, and that the naval and military divisions shall obey. To do otherwise is to court failure, and perhaps also the dishonor of a hasty surrender without having first developed all the means of defense, as happened at Port Arthur. It avails nothing to say that the result could have been different; the essential thing is that the military honor be unspotted.

The proceedings for the surrender of Port Arthur marked a painful page in the military history of Russia, and the lesson is being pondered.

HAMLEY'S

OPERATION OF WAR.

Demanding, then, as this question does, diplomatic as well as military sagacity, it will be most effectually solved when the chief of the state combines the characters of ruler and soldier; and it is not the least of the advantages which a military autocrat, like Frederick or Napoleon, possesses in war, that all the circumstances are apprehended by a single mind, and the decision has all the force and coherence which unity imparts. But when generals are commissioned by their governments to execute warlike enterprises, the questions which depend chiefly on diplomacy must of necessity be solved by statesmen, who, having thus given to the campaign its original impulse and direction, will do well to leave the formation and execution of the military plan in the hands of the general. In practice, however, it is often difficult to reconcile military with political considerations. Thus in 1866 the success of von Moltke's plan was seriously endangered by the delay which was forced on him, for political reasons, by the Prussian Government. In 1870 the disaster of Sedan was caused by the French Government insisting, for political reasons, on MacMahon's movement towards Metz. In war ultimate political success must depend on military success, and the policy which insists on unsound military measures is likely to defeat its own ends. On the other hand, in framing a plan of campaign a general must make full allowance for political exigencies. The failure of McClellan's operations in 1862 is a warning of the danger a general incurs when he attempts to carry out a plan to which his government accords only a half-hearted support.

DOCTRINE OF NATIONAL DEFENSE.

Translation from "Entre l'Allemagne et l'Angleterre," by Captain P. Sorb, French Navy.

"For the third time I recall the principle enunciated by President Roosevelt. In dealing with our foreign policies and, in general, with the attitude which must be maintained by a great nation in the world, it is absolutely necessary to consider first the army and the navy.

"For the application of this principle it is indispensable that the authority charged with the control of our foreign policies have a perfect understanding of the capacity of the army and of the navy. The progress of our foreign policy must be governed by the worth of our naval and military resources. We are not free to choose 'a priori' our friends and adversaries on the day when these compel us to engage in war; we must know if these are such as to assure to us the elements of success or defeat.

"It is not at the moment of strained diplomatic relations that the President of the Council and the Minister of Foreign Affairs should call on the general-in-chief and on the commanders-in-chief of our naval forces to ascertain from them if they are ready to act in the event of such and such a contingency. In a methodical and continuous manner must the government be kept informed of the exact status of the army and of the fleet, since these are the two essential factors to be considered in maintaining our foreign relations.

"The necessity is therefore evident for the intimate coordination between the directing organs of foreign relations and army and navy. Confronted by foreign powers, we must not embark on new ventures, engage in new negotiations without having beforehand carefully considered all the military consequences of a new policy, and without having looked carefully into what we actually shall be able to do, either alone, or with the aid of allied forces. If the projected combination will lead us some day into armed conflict, the Minister of Foreign Affairs must consult the competent authorities of the army and of the navy in order that they may examine together new 'concrete cases' which they may be led to consider, after which, he can arrive at a decision fully cognizant of his course of action.

"In thus dealing with this matter we will avoid dangerous combinations and the possibility of being some day forced to the dire necessity of making concessions and of taking retrograde steps which tend to lower our self respect, and be detrimental to our interests and to our standing among the nations of the world. But, before establishing this bond between the diplomatic authorities and those of national defense, we must first assure ourselves of cooperation between the last, that is to say, between the army and the navy."

CHARLES À COURT REPINGTON.

Military Correspondent of London Times.

"THE FOUNDATIONS OF REFORM," P. 180.

Every one will agree that heads of departments cannot be permitted to wage war on their own account, even with the aid of their expert advisers, without reference to the proceedings of their colleagues. There must be

a point of union, and from this point the central impulsion must derive and extend downward over the action of every department to the extreme confines of the uttermost possession of the crown. This central point must be the Cabinet, because it is the depository of power in a constitutional monarchy. The advisory council of the Cabinet in affairs relating to war is the Committee of Imperial Defense. *This is the Prime Minister's committee,* and though it has a semi-permanent composition, he calls to it whom he pleases, many or few. When it is assembled in full strength it is practically a committee of the Cabinet strengthened by expert official advisers. It is then the lineal descendant of the Secret War Council over which Pitt rather dominated than presided. If war is to remain an act of government it is from the council-room in Whitehall Gardens that all initiative in war must emanate, and by this committee that every proceeding of a war must remain controlled, so far as it lies in the power of one side to control a game in which there are two players.

The committee combines knowledge with power, but owing to the autocratic powers which strong ministers occasionally arrogate to themselves, the fact will not necessarily result in unity of direction and coordination of all effort to a single end unless steps are taken in advance to secure these advantages. It is better that we should regulate in advance, and in a manner stereotype, principles for the direction and control by the committee of all concerns of war than arrive painfully at the same end in the midst of a war after shedding recalcitrant ministers and upsetting, as in 1757, the entire machinery of government. We therefore require that there should be embodied in a state paper and accepted by every minister on assuming office, the principles by virtue of which every department of government shall obey without question or delay the directions of the Defense Committee the instant war is imminent or occurs, and whereby the centralized control of events shall be absolutely, uninterruptedly, and efficiently maintained.

No one would desire or propose that the committee should interfere with the administration of army or navy, should concern itself with the operations of armies or fleets, or should attempt to diminish by one iota the initiative and independence of commanders. Pitt never attempted to do that. What Pitt did, and what the committee must do, is to define clearly the objects in view, to secure the provision of forces adequate for the purpose, and then to leave to commanders unfettered liberty of action within the limits of their particular missions, and to departments the express duty of supporting these commanders with all the resources at their disposal.

Even if the general plan of the campaign established by the Defense Committee is not exactly brilliant, it is better for the country to pursue an ordinary plan with unanimity and vigor than to allow dispersion of effort and war by fits and starts which would infallibly result from warfare by departments. If the army has its plans, the navy its plans, and other departments their several and separate objectives, nothing but confusion and disaster can be expected. If the navy suddenly asks for 20,000 troops before the army is mobilized, or the army for convoy which cannot be provided, we should soon be in a parlous plight. It is imperative that every initiative

in the largest sense should come from the committee, which can alone be in a position to maintain a clear, impartial, and uninterrupted view of the whole world-wide theater of a war.

Many other departments besides the Admiralty and the War Office will be concerned in a great war, notably the Exchequer, the Foreign, Colonial, and Indian offices, and the Board of Trade. The mission of each one of these departments should be defined in advance to meet the case of at least one great war, which may not prove to be a remote contingency. The work of one of these departments—namely, the Foreign Office—is distinct from that of others, since it is more by preparation of the ground before war breaks out than by activity afterwards that it can, as a rule, render the greatest services.

BISMARCK.

THE MAN AND THE STATESMAN.

II.

If the theory which the staff urged against me, and which is said to be taught as part of military science, can be expressed by saying that the Minister of Foreign Affairs comes again to the fore only when the commanders of the army find that the time has arrived for closing the temple of Janus, surely the double face of Janus conveys the warning that the government of a state engaged in war must look in more directions than towards the scene of the struggle only. The task of the commanders of the army is to annihilate the hostile forces; the object of war is to conquer peace under conditions which are conformable to the policy pursued by the state. To fix and limit the objects to be attained by the war, and to advise the monarch in respect to them is and remains during the war just as before it a political function, and the manner in which these questions are solved cannot be without influence on the method of conducting the war. The ways and means of the latter will always depend upon whether the result finally obtained is the one desired, or more or less; whether cessions of territory are to be demanded or forborne, and whether temporary occupation is required, and for how long.

Still more difficult in the same line is it to judge whether and with what motives other powers might be inclined to assist the adversary, in the first instance diplomatically, and eventually by armed force; what prospect the representatives of such a combination have of obtaining their object in foreign courts; how the parties would group themselves if it came to conferences or to a congress; and whether there is danger of further wars being developed from the intervention of neutrals. But above all is the difficulty of deciding when the right moment has come for introducing the transition from war to peace; for this purpose are needed knowledge of the European conditions, *which is not apt to be familiar to the military element, and information which cannot be accessible to it.* The negotiations at Nikolsburg in 1866 show that the questions of war or peace always belong, even in war, to the responsible political minister, and cannot be decided by the technical military leaders. But the minister concerned can only give the king expert advice, if he possesses a knowledge of the actual position at any moment and of the views of those who conduct the war.

(*London Times*, January 11, 1912.)

THE NAVAL WAR STAFF.

DEVELOPMENT OF THE SCHEME. EVOLUTION NOT REVOLUTION.

(*By our Correspondent for Naval Affairs.*)

Not the least of the merits—which have been generally acknowledged—of the scheme for the constitution of a War Staff for the navy promulgated on Monday by Mr. Winston Churchill is that it is essentially an evolution and not a revolution. It leaves unimpaired the powers, statutory and prescriptive, of the Board of Admiralty, and it seeks to provide it with a well-organized thinking department by development and not by reconstruction. The Admiralty is one of the oldest institutions of the state. It has a long and eventful history—a history which goes much further back than that of any of the instruments which authorize without exhaustively defining, and thereby circumscribing, the due exercise of its very multifarious functions, and the dominant fact in this history is that, in spite of many and grievous shortcomings, it has conducted naval war in the past with unexampled success. "The more I have investigated the matter," said Sir James Graham in 1861, "the more I am satisfied that, like the Common Law in aid of the Statute Law, the power exercised by the Board of Admiralty and the different members of it rests more upon usage than upon the Patents, uninterrupted usage from a very early period." To such an institution, so immemorial and withal so flexible in its usages, so illustrious in its achievements, the method of development is manifestly more appropriate than that of reconstruction. A War Staff for the navy should, therefore, be a new organ, spontaneously evolved from within rather than something imported and grafted on from without. I would define it as a necessary extension of the mind of the Board, and especially of the First Sea Lord.

THE FIRST SEA LORD AND THE STAFF.

By the Order in Council of August 10, 1904, the several Sea Lords were "to be responsible to the First Lord of the Admiralty for the administration of so much of the general business connected with His Majesty's Navy and with the movement and condition of His Majecty's Fleet and with the personnel of that fleet as shall be assigned to them or each of them from time to time by the First Lord." Under this Order in Council a scheme for the distribution of business was promulgated by the then First Lord, Lord Selborne, on October 20, 1904. The business assigned to the First Sea Lord by this instrument was in general terms "organization for war and distribution of the fleet." More specifically this business was distributed under three heads—"1. Preparation for war: All large questions of naval policy and marine warfare—to advise. 2. The fighting and sea-going efficiency of the fleet, its organization and mobilization; the distribution and movements of all ships in commission or in fleet reserve. 3. The control of the Intelligence, Hydrographical, and Naval Ordnance Departments." Having regard to the executive, as apart from the administrative functions here assigned to the First Sea Lord, it is plain that, as Mr. Churchill points out in his memorandum, that officer "occupies for certain purposes, especially the daily distribution of the fleet, on which the safety

of the country depends, the position of the commander-in-chief of the navy, with the First Lord immediately over him as the delegate of the crown in exercising supreme executive power." Now, inasmuch as every commander-in-chief afloat is provided with a staff charged with the duty of working out in detail his orders and plans, and with the clerical formulation of his orders necessary to give them due executive effect, it follows by parity, not to say by cumulation, of reasoning that in so far as the First Lord is a commander-in-chief, he must have a similar staff, more highly organized in its structure and more extensive in the scope of its operations if he is efficiently to discharge the supremely responsible duties imposed upon him—and this all the more because in addition to the executive duties of the commander-in-chief he is also charged with administrative duties of great moment and pressure. The same reasoning points with equal cogency to the necessity of providing him with a chief of the staff whose special duty it must be to coordinate and bring to a focus all the business of the staff for his final consideration and decision.

THE INTELLIGENCE DEPARTMENT AND ITS EVOLUTION.

All this has long been recognized in a certain sense, and the Intelligence Department, first established more than 20 years ago and subdivided more than two years ago into an Intelligence Department proper and a Mobilization Department, was the first embodiment at the Admiralty of the idea of a War Staff. In an inchoate form the Intelligence Department became the staff of the First Sea Lord and its director was his chief of the staff. But with the progressive increase of the fleet the business of collecting war information, of preparing war plans, and of formulating war arrangements has grown far beyond the capacity of a single officer directing a single department to transact with due efficiency and despatch. What has been done now is to add another division of supreme and almost incalculable importance, the Operation Division, to the two divisions of Intelligence and Mobilization already existing; and since the business of these three divisions is all intimately and organically correlated and the directors of each are to be coequal in rank and authority, the analogy of sea command is again to be called in aid, and a chief of the staff is appointed to collect into a single strand all the threads of business issuing from the several divisions.

THE OPERATIONS DIVISION.

The separate constitution of the Operations Division may well be regarded as the crowning of the whole edifice. In the due coordination of war information, war plans, and war arrangements, the whole art of war may be said to consist. The information must be the most accurate and exhaustive that intelligence and industry trained in its pursuit can obtain; the plans must be the most sagacious that the highest and most instructed strategic insight can devise; the arrangement must be the best that can be made for the effective prosecution of the plans so devised. Of these the plans are by far the most important, and require the largest measure of trained intelligence for their preparation. At the same time, it is necessary

to give due heed to a passage in Mr. Churchill's memorandum which has not as yet received much attention:

"Although the methodical treatment of the vast number of subjects to be dealt with by the staff requires that there should be divisions and subdivisions, yet it is imperative that these should never be permitted to develop into "watertight" compartments. It will be found that there is so much overlapping between divisions that a constant, free and informal intercourse between them is indispensable. To promote this the chief of the staff will be enjoined to hold frequent meetings to be called 'staff meetings,' with the heads of the three divisions, and each of the directors will be kept fully acquainted with the work of their two colleagues. Each one of the directors will be ready at any moment to act for the chief of the staff in the latter's absence from whatever cause."

This is perhaps the explanation of the otherwise rather questionable provision that "the chief of the staff will not be the sole channel of communication between the First Sea Lord and the staff; and the First Lord and the First Sea Lord will, whenever convenient, consult the directors of the various divisions or other officers if required." Some misgiving has already been expressed by the *Times* in regard to the working of this provision. If the Admiralty were not a department *sui generis*, instinct with that spirit of give-and-take and mutual cooperation which is needed to the sea service, I should share that misgiving. But in Admiralty administration the spirit is everything, while the letter counts for very little in comparison and I am confident that in this case, too, the spirit will prevail over the letter, more especially as, like the sea itself, the staff is to be "all one."

ADMIRALTY AND WAR OFFICE.

"It is necessary," said Mr. Churchill, "that there should be a close and whole-hearted cooperation between the War Staff at the Admiralty and the General Staff of the army." That might be regarded as a self-evident proposition, were it not notoriously the fact that the relations between the Admiralty and War Office have often been of that "watertight compartment" character which Mr. Churchill so justly deprecates in respect of the several divisions of the Naval War Staff. There are many problems of war which concern the navy and army in common; indeed, it might almost be said that there are not very many which directly or indirectly do not. Yet it is also notorious that the solutions of these problems which have commended themselves to the Admiralty have often proved very far from acceptable to the War Office. How far a closer and more whole-hearted cooperation between the staffs of these two departments may tend to resolve these antinomies in the future experience alone can determine. It may be conjectured that when staff meets staff then indeed will come the tug of war; and for the reconciliation of those fundamental divergences which, as Mr. Balfour pointed out in 1905, have existed almost from time immemorial between different schools of naval and military thought, we may, perhaps, look as Lord Haldane seems to look, to another and higher authority than any which resides either in the War Office or in the Admiralty. Speaking at Edinburgh on Monday, Lord Haldane said:

"The Navy had now got, like the Army, a General Staff. The Navy and the Army were now going to cooperate in this problem of defense in a fashion they never did before. They had now got the two brains of the two Services thinking out these war plans . . . . thinking out the great coordination of the Army and the Navy. These two staffs had above them a yet more General Staff in the Defense Committee."

It is in this direction that almost certainly lies the true solution of the problem which some people thought might be solved by the appointment of a Minister of Defense supreme over both War Office and Admiralty. *The only possible Minister of Defense of this character in this country is the Prime Minister,* who is, by the prescriptions and usages of the Constitution, supreme over all departments in respect of all high matters of policy. The Committee of Imperial Defense is the General Staff of the Prime Minister in his capacity as the ultimate Minister of Defense—an extension of his mind in so far as it is applied to the higher problems of defense. If the Admiralty and the War Office differ and cannot be brought into agreement by the agency of their respective staffs their differences must be brought to the Prime Minister and finally decided by him in the light of exhaustive discussion at the Committee of Imperial Defense. The creation of the War Staff at the Admiralty will enable the two departments to meet on equal terms in their joint deliberations. But it will not necessarily establish harmony between them, since each is coequal with the other in his own sphere of activity. That can only be done in the last resort by the agency and procedure just indicated.

TRAINING FOR THE WAR STAFF.

It is significant of much that the creation of a War Staff for the Navy and the emergence of an Operations Division as an organic element in its evolution should synchronize with a recognition by the Admiralty of the urgent need for a special course of training for the officers who are to serve on the War Staff of the future. Hitherto Staff officers in the Navy have had to learn their duties according to the method prescribed by Mr. Squeers, namely, by doing them. Henceforth they will first be taught how to do them. Mr. Churchill enunciates two most excellent principles which are to be regarded as paramount in the constitution of the Staff College—for so we may call it though it is not so designated in the memorandum, being there rather regarded as an internal development of the already existing War College—now to be provided for the navy. First the personnel of the War Staff . . . . will consist of naval officers fresh from the sea and returning to the sea fairly frequently." That is a condition quite indispensable to the efficiency of such a service as the navy. The higher leading in naval war must never be divorced from direct and frequent contact with the sea.

Secondly, nothing in the constitution of the staff will be designed to arrest the free play of professional opinion in all its members from top to bottom. Fresh ideas, new suggestions bred by independent study and reflection may find their proper expression in all ranks. Disciplined cooperation in working out schemes which have been prescribed will not exclude reasoned

criticism and original conceptions, the central objects being to form at once a convenient and flexible machine for the elaboration of plans and a school of sound and progressive thought on naval science.

All this is quite admirable. The Staff College and War Staff emerging from it must never be a school of unchanging dogma. It must be an agency for the cultivation and dissemination of living and progressive thought. It is to think and not to act. It will in no way control or fetter the mind of the First Sea Lord and others, who are to act, it may be, on its inspiration, but on their own sole responsibility; but it will inform it and thereby fortify its executive decisions with all the authority to be derived from sustained thought based upon exhaustive information. It must never be allowed to usurp any of the functions and responsibilities proper to the Board of Admiralty or to any of its members. But there can be little doubt that in course of time its influence, direct and indirect, will prove to be the little leaven that leaveneth the whole lump. After all, the brain is the directing member of the organism.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE RELATIVE IMPORTANCE OF TURRET AND TELESCOPE SIGHT.

By REAR-ADMIRAL BRADLEY A. FISKE, U. S. Navy.

The value of the turret is recognized. The victory of the *Monitor* over the *Merrimac* was so opportune and dramatic, and its results were so evident, important and immediate, that the turret was at once proclaimed, by all the world, to be one of the greatest inventions of the age.

The telescope sight, on the other hand, made its obscure little debut on a small gun-boat, way up in Bering Sea; its value was not realized for ten years; and it grew so slowly into use that it came gradually to be regarded as a "matter of course." Though adopted now by every civilized navy in the world, it has nevertheless received no individual recognition; and yet there are some who think that it is a more important factor in naval warfare than the turret.

To compare the relative values of the turret and the telescope sight, let us imagine two ships, *A* and *B*, meeting on the ocean and fighting; *A* having open sights and turrets, and *B* having telescope sights and no turrets, *B's* guns being arranged in broadside.

Which ship would whip?

A would be able to fire, say, ten guns on a broadside, and *B* only five. As to firing ahead or astern, *B's* guns would probably be disposed according to the old-time plan, with the forward and the after guns on two different decks, so that she would be able to fire four guns ahead and four astern, the same as *A*.

Of course, the proper tactical utilization of greater accuracy of gun fire would dictate that *B* should keep at a very long range and not present a long target laterally, so that *B* should keep *A* on his bow or quarter as far as practicable. But in order to make our comparison applicable to a fleet action, we have to assume that

both ships turn their broadsides to each other, and engage at some moderate distance, say 10,000 yards. In this case, *A could* fire twice as many guns per minute as *B;* so that, if the accuracy were the same in the two ships, *A* would probably hit *B* twice as often as *B* would hit *A*.

But the accuracy would not be the same. It is impossible to state exactly what the ratio of accuracy would be; but it certainly would not be unfair to the open sight, if we accepted the same ratio as characterized the performance of the two sights on the only occasion when their value could be compared under identical conditions. This was the first time the telescope sight was ever tried. It was on board the *Yorktown* at Unalaska, on September 12, 1892. A diagram of the firing is here shown.

If anyone will take the trouble to measure off the vertical deviations of the two series of shots, he will find that the mean vertical deviation of the shots fired with the open sight was 6.54 feet, and with the telescope sight 2.25 feet, the ratio being as 2.91 to 1. This is on the supposition that the five shots fired with the open sight, and which could not be plotted on the diagram (which extends 15.75 feet above the mean point of impact), had a mean vertical deviation of 15.75 feet. If he will also measure the mean lateral deviations of both series of shots, he will find that they are 8.90 feet and 2.75 feet respectively, the ratio being as 3.23 to 1.

It is not here claimed that the shots were plotted with mathematical accuracy, but that they were plotted with a sufficient approximation to accuracy to form a fair basis of comparison, and as accurately as the appliances of that day permitted. The fact that the fourth shot brought down the target in a mass on the raft, and that the target was found to have three holes in it when examined, indicates that the shots fired with the telescope sight are quite accurately plotted.

The fact that the last shot, fired with the telescope sight (No. 23), was fired at the vague mass of wreckage, and therefore ought not to be counted, is here ignored.

Certainly it could not be objected with reason that the ratio, 2.91 to 1, is unjust to the open sight. The great accuracy of naval gunnery to-day, as compared with its accuracy before the invention of the naval telescope sight, indicates a much larger ratio than 2.91 to 1; and this larger ratio cannot be due to im-

proved methods of drill and training, or to the effect of spotting and fire control; because, while these things increase the rapidity and the effectiveness of the fire of a group of gnus, they do not and cannot increase the accuracy of the fire of any individual gun beyond its own inherent accuracy. They simply utilize that accuracy.

Suppose *A* and *B* approach to a distance of 10,000 yards and begin to fire. It is clear that the vertical target presented by each ship would be about 30 feet, and the mean vertical deviations of *A* and *B* about 49.5 and 17.03 feet respectively; so that, referring to page 129 of Alger's Exterior Ballistics, we see that the respective probabilities of hitting, in the case of each gun in the respective ships, would be in the ratio of about 2.71 to 1 in favor of *B*, supposing both ships to have their mean points of impact on the centers of their respective targets, a supposition not unjust to the open sight.

The veritical deviations, 49.5 and 17.03 feet mentioned above, are based on the assumption that if the deviations with the open sight and the telescope sight were 6.54 feet and 2.25 feet respectively at 1320 yards, both deviations would be increased in the ratio 10000/1320 at 10,000 yards. But both would really be increased more than this, because not only does the deviation, with a clear target, increase as the range, but the target becomes dimmer, thereby causing increase of deviation; and this increase of deviation would be greater with the open sight than with the telescope sight, for the reason that the telescope clears up the target and gives a definite point of aim.

The figures 49.5 and 17.03, therefore, are not unfair to the open sight, but the reverse.

By reason of the great lateral targets presented by the ships relatively to the mean lateral deviations of the guns, the superior lateral accuracy due to the telescope sight would have little weight, and it is therefore ignored here.

It is impossible to reason out which ship would begin to fire first. So it must be assumed that they would begin at the same time.

B, of course, would use salvo firing. Whether *A* would or would not use salvo firing, it is impossible to say; but it is safe to say that he would do better by not attempting it. Previous to the introduction of the naval telescope sight, salvo firing with open

gun sights had been found extremely inaccurate and was only used at very short ranges. Some ships, especially in the British Navy, were fitted for salvo firing, but by electricity and from a "directing station," where the officer who fired the battery, used a telescope for sighting.

It seems sure that *A's* fire per gun would not be so rapid as *B's*. *B* could fire her five broadside guns in salvo once in 30 seconds. But with the open sight, where the main difficulty was in getting the pupil of the eye exactly on the line joining front and rear sights at the same time the line of sight was on the target, a "gun-captain" had frequently to wait a long time after his gun was loaded before he could get "a good sight." It must be remembered that it was necessary for him to have his pupil on the line of sight not only in the vertical plane, but also in the horizontal plane; and that if he lost his chance at the end of one roll he would have to wait until another roll came along. Besides this, *A's* firing would undoubtedly be handicapped by the smoke of one gun interfering with another gun, and, in the case of any single turret, by the fact that one gun would have to wait until the jar caused by the other gun had subsided.

Bearing in mind the fact that the firing on board the *Yorktown* was done at anchor in smooth water and at an anchored target, when it was comparatively easy to keep the pupil of the eye on the line of sight, so that the conditions were much more favorable to the open sight, as compared with the telescope sight, than would obtain under ordinary conditions on board a ship under way at sea, firing at a moving target, it would seem that, in order to attain the relative accuracy of fire between *A* and *B*, which was found on board the *Yorktown*, the rate of fire per gun of *A* would have to be extremely deliberate; certainly not greater than one shot per gun per minute, about one half of that of *B's* guns. That is, the number of guns fired per minute on board the two ships would be about the same.

This means that the hits per gun per minute would be as 2.71 to 1, in favor of *B*, supposing that both ships got their mean points of impact on their respective targets at the same instant, and supposing also that there is no cumulative effect in an "initial advantage."

But they would not get on their targets at the same instant and there is a cumulative effect in the "initial advantage."

B's spotter, after one or two ranging shots, would probably straddle the target with his first or second salvo, and in about a minute after the first ranging shot would begin to land 25% of hits on *A;* that it, 2½-12 inch shots per minute.

It is highly improbable that *A* could get his mean point on *B* by this time. His task would be extremely difficult. Not only would he have a large dispersion in range to deal with, but, as the projectiles would not fall into the water together but separately, and at irregular intervals of time, his calculations as to how much to raise or lower would be complicated by the necessity of remembering how the various shots fired with a certain sight bar range had fallen; and it would be practically impossible to even ascertain this after he had raised or lowered once, because he would not know whether the last shots had been fired with the last range he sent down, or the previous one. His difficulties would be increased too—compared with those of *B's* spotter—by the larger lateral dispersion.

All these difficulties would increase after *B* began to hit; and then the people in the turrets, conning tower and elsewhere would begin to have their troubles. These troubles would increase, and would cause confusion, and would progressively augment *B's* initial advantage; so that it is possible that *A* might be defeated without ever getting his mean point of impact on *B* at all.

But let it be imagined that both ships get on their targets at the same instant, and that *B's* only advantage is the relative probability in h. p. g. p. m. of 2.71 to 1 in *B's* favor.

The only advantage which *A* would have to oppose to this offensive advantage would be the defensive advantage due to the superior protection given by her turrets; and this would simply be due to the fact that the ports through which *B's* gun would have to fire, in order that the guns might have a sufficient train, would be much wider than the ports in *A's* turrets. But the width of *B's* ports perpendicular to the line of fire would not be greater than the inside diameter of *A's* turrets; that is, about three times the width of *A's* ports; and the lateral target of even a whole turret is so small, relatively to the mean lateral deviation of the gun, that the superior probability of hitting laterally attained with the telescope sight (ratio about 3.11 to 1, assuming the data of trial on board *Yorktown*) would have to be taken into account; so that the probability of hitting a turret or any-

thing of similar dimensions would be, not as 2.71 to 1, but as 2.71 x 3.11 to 1, equal to 8.43 to 1, in favor of *B*.

Therefore, the greater width of *B's* gun ports would be more than counterbalanced by the greater probability that *A's* ports, or the guns in them, would be hit; and the probability of a shot entering a port *or* striking a gun would be about as 8.43 to 3 in favor of *B*.

The probability of striking a gun would, of course, be about 8.43 to 1, in favor of *B*.

It will be noted that no account is taken here of the fact that the turret itself, or the armor in front of and over the broadside gun, is not really invulnerable; and that, even if it were, the shock of receiving a 12″ shell would be very detrimental to the personnel and material behind.

There would still remain, therefore, the original probability of 2.71 to 1 in favor of *B*, an advantage nearly equal to the advantage that three sister ships would have over one other sister ship.

Of course, the ratio of probabilities would really be much greater than this, but to a degree that eludes computation. This ratio of 2.71 to 1 takes account merely of the probability of hitting the areas exposed by the entire ships as targets. It disregards entirely the advantage *B* would have in his ability to use salvo firing, the cumulative effect of "the initial advantage," which *B* would get at the start, and the advantage *B* would have in being able to direct his fire at will on individual parts, such as the conning tower. It also neglects the fact that the probability of hitting the conning tower would be about as 8.43 to 1 in favor of *B*.

It would seem then that *B* would whip *A*, and quickly.

We have thus far limited our comparison to gunnery warfare. But there is another very important field of naval warfare, and that is torpedo warfare.

So let us suppose that *A* and *B* are attacked by destroyers, in the daytime. At night, the telescope sight has an unquestionable advantage, but it is small.

As the destroyers would head towards their respective target ships, the lateral targets presented to those ships would be so small that the smaller lateral deviation due to the telescope sight would have to be taken into account, as well as the the smaller vertical deviation; so that the probability of hitting the area

presented by a destroyer would be about 8.43 times as great with the telescope sight as with the open sight.

This means that, with a given degree of risk, one group of destroyers would have to keep nearly three times as far from *B* as the other destroyers from *A;* and that *B's* chances would be 8.43 times as good as *A's*.

It also means that, if we did not have the telescope sight, destroyers, without taking a greater risk than at present, could approach battleships by day to nearly one-third of the distance which they must now observe; that is, close to the distance at which their torpedoes are effective. In this case, it might be a serious question whether it were worth while to build battleships at all. Certainly it would be a serious question with the Congressmen who appropriate the money.

The destroyer has been gaining rapidly in seaworthiness and speed, and the torpedo itself in accuracy and range. The destroyer has been menacing and is menacing the very existence of the battleship, not only in war, but also in peace; for the strongest argument against appropriating money for battleships is the torpedo. The only thing that keeps away the destroyer is the gun; and a group of destroyers could approach a battleship, and fire torpedoes at her, with considerable chances of success, at 4,000 yards in the daytime, if they were not fired at by accurately sighted guns.

But it is not necessary to limit our supposed attack to destroyers. Let us suppose that *A* and *B* are attacked by fast cruisers, whose machinery and torpedoes would be below the water line, so that their degree of immunity from being sunk would be much greater than that of destroyers. Such cruisers, unless in very large numbers, would have no chance whatever against *B;* but an attack of say six against *A* would have a respectable chance of success. How many such vessels would be required to sink *A,* no man can tell; but it is certain that *B* could stand off at least 8.43 times as many as *A* could.

Therefore, it is possible that, were it not for the naval telescope sight, the battleship including the turret might have become obsolete before now. It is certain that battleships would have much less than their present effectiveness to plead as a reason for their existence, that they would fall an easier prey to the torpedo, and that we should have had, and should still have, very much more difficulty in getting money to build them.

The turret has no field of usefulness in torpedo warfare, and is applicable to battleships only. The naval telescope sight has an important field in torpedo warfare, and is applicable to all kinds of vessels. Over the whole world to-day, there is hardly a modern gun on board a modern vessel that is not fitted with telescope sights.

In the war between Japan and Russia, the destruction of the Russian fleet at Tsushima was so complete as to end the war. The main cause of its destruction was that the Russian gunnery was less accurate than the Japanese. The more accurate gunnery of the Japanese secured an initial advantage in the beginning of the battle; and this advantage, according to a natural law, increased in geometrical ratio as the battle went on, and became overwhelming in a few minutes.

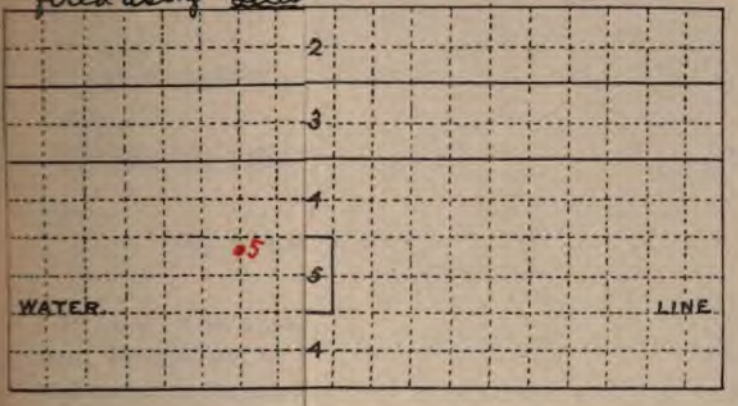
It has been stated on excellent authority that the Japanese guns were fitted with telescope sights in good order, while very few of the Russian ships had telescope sights, and that the telescope sights which were fitted were not in good order.

If this be true (and it probably is), the reason for the sudden annihilation of the Russian fleet stands out sharp and clear; and we see that *the naval telescope sight, more than any other one thing, was the cause of the turning of the tide of history in the direction in which it did turn.*

If this be true (and it probably is), the influence of the telescope sight in the Russo-Japanese war was greater than the influence of the turret in our Civil War.

Note

The dots and figures ... points of impact of ... fired, using ordinary ... and Telescopic gun sight ... cannot be plotted on this sheet.



Shots 1. 4. 5 and 6 are plotted on this sheet.

Lieut, in charge 1st Division

Shots 7. 8. 9. 10. 11 and ... charge 2d Division

Shots 16. 17 and 18 ar... plotted on this sheet.

Lieut in charge 3d Division

Shots 19. 20. 21. 22 ar... accurately plotted on Ensign and observer

Shots Fired.	Guns, Number and Class.	
	6" B.L.R	

U.S. Yorktown.

September 12, 1892

...: Unalaska, Alaska.

...er: Light breeze. Clear.

...reat at instants of fire.

...ching: 1° each side;

pitching imperceptible.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON THE SWEDISH SYSTEM OF PHYSICAL TRAINING.

By SURGEON J. A. MURPHY, U. S. Navy.

In view of an apparent increasing interest in physical betterment, brought out by executive order bearing on the subject; by realization on the part of many that a good body is necessary to withstand the demands on physique of the present increasing tension of naval life, which can be expected to increase enormously in time of war; and, by such results represented by sickness, medical surveys, early retirement, and in other ways under the broad qualification of decreased efficiency, following the presence of defectives in the personnel; it has been deemed of value to compile and arrange some data on the subject which might be of use to the individual concerned as a manual of physical training.

Physical training in this country as a general institution has, until recently, been confined almost entirely to the athletic variety in which the superior physiques, already superabundantly endowed by nature, engage in activities of various kinds called sports with the ever present idea of outshining someone else in a particular form of effort.

The various sports or games were originally intended as a beneficial means of improving physique so as to fit the subject the better for his future activities in life; through specialization, however, the recreational element and ultimate aim of exercise has been lost sight of, and they no longer serve the purpose. In the desire to win at any cost only those points are considered which tend to this end. Such retrogressive tendencies as have developed have been fostered by stimulated ambition on the part of contestants, by the desire of many institutions for the advertisement success brings, and by a class of men gradually evolved by these conditions whose livelihood depends on turning out winning teams.

These men (coaches, trainers) have at the most an insecure tenure of office and even when properly qualified by knowledge or experience in the use or misuse of the human body, through lack of time can give very little consideration to progressively developing a weaker subject, who invariably soon drops by the wayside, leaving the superior material to be forced to a condition of physical excellence calculated to bring out one or at most several supreme efforts.

In this scheme of development the good or bad effect is centered in a few, and the many have been left to shift for themselves. It is very evident that the forcing process is having its harmful effect not only on the exceptional physiques, but also on those of weaker physique who try to emulate the example of the strong, in many instances apart from observation and advice because of the trainers' concentration of thought on more likely candidates, or by reason of a general emulation, as witnessed by the effect on school children after the Dorando-Hayes marathon race. These near athletes having no athletic history rarely get into the statistics (except as men of non-athletic type) when from time to time proof is offered as to the benefits to be derived from machine athletics.

It is to be noted that statistics, heretofore advanced as a means of proving that certain forms of athletics are not harmful, have been based on those exceptional physiques who were the survival of the fittest in that their names were recorded as stars. The statistics refer only to longevity and the comparison is a general one, all types of non-athletes being taken as examples on the other side of the question. A comparison between the non-athletic, robust man and his athletic fellow would yield different results. In the last report of the Surgeon General, U. S. Navy, the medical records of 625 Naval Academy athletes (covering a period of 20 classes) were looked into, and of this number 21 have died or retired, and 198 show defects referable to their athletic activity, affecting their future efficiency as officers in the Navy. It can be expected that this result will be more suggestive in view of the fact that the earlier athletes worked under less pressure (records not so low) and that the later athletes have not been under observation long enough for constitutional effects to show.

The modern idea of athletics is to make a machine out of the human body and to run this machine to a limit short of producing

an immediate and irreparable smash-up. When it appears that skill is absent, or is equal, the tendency is to make endurance supreme, and when this element enters and is carried too far, it is a common occurrence for individuals to collapse despite exceptional physiques to start with and special preparatory training.

If the condition of preparedness for maximum effort could be made a lasting process it would be justifiable. The onset of a condition known as staleness (a symptom of rebellion on the part of the body) renders this a failure however, and repeated doses of muscle and nerve fatigue soon lessen the individual's usefulness, as is evidenced every day by the rise of new stars, and the brief reign and fading glory of those of yesterday.

In a military organization the general speed and efficiency will come from the bottom, and not from the few superior physiques at the top, and here more than in civil life physical training should be devised to improve the weakest type and maintain the vitality of the individual at a point where, if called on in battle, he can wreck his health to national advantage.

The high tension athletics of the present day can be considered of questionable benefit to the few men engaged as contestants, and to the many who look on as spectators of no benefit whatever. Under the present system it is very difficult to get average individuals to gather together to form a team of some kind for a contest of pleasure and recreation as is the practice of the English.

Any form of physical effort, when too frequently engaged in; too long continued at one time; or, when the individual is forced by his training or by the desire to win, to ignore certain warnings of nature (breathlessness, constricting sense about chest, black specks in vision, dulling of sensation, extreme fatigue, etc.); can be expected to produce harmful results. On the other hand the same exercise when carried out progressively, always within the power of the individual, and short of fatigue or the signs of cumulative strain, cannot be but beneficial, as proved by the different reaction (pleasureable sensations, animation, bright eyes, cheerfulness, and continuous increase in vital power, without the need of careful nursing, diet, etc.).

Realizing the disadvantages of specialized athletics there has been unfolded, in the last few years, an increasing sentiment toward developing the many, who in the end really need consideration, and as a result nearly all the universities and schools in

the country have adopted a more or less effective course of compulsory physical training comprising gymnasium work and athletics. In connection with athletics there is a tendency to restriction by means of limitations of various kinds (medical, strength, and scholarship standards; lessening number and duration of contests; and to prevent constant training, permitting one individual to engage in but two sports each year). More attention is being paid to inter-institutional contests in order to reach those who cannot make the varsity squad, the members of which are barred from inter-class teams.

This year for the first time at the Naval Academy compulsory gymnasium physical training was established for all midshipmen, partly as a result of observation on over 1700 midshipmen of the classes 1900 to 1910 which showed that even including the athletes, first classmen on the average actually decreased in weight and relatively decreased in strength when compared with their second class year. Under the present system of compulsory gymnasium drill for all classes restraint is being enforced in different ways in connection with athletics, the effect being to stimulate a desire for uniform development, and to spread the athletic material into more lines, and to get more men out, and in consequence it is hoped to obtain better results. The gymnasium drills are still insufficient in number, consisting of only one hour weekly for 16 weeks during the four winter months, but those midshipmen found deficient in strength and swimming receive in addition 2½ hours extra drill weekly.

The dynamometer strength test in use at the Naval Academy is the basis for the course in physical training. This test is given to each midshipman in October and April, and serves to classify the individual as strong or weak, besides giving him an idea of his weak and strong points. The test as now given, while coarse in some respects, shows without question the effect of different forms of exercise both as developers, and, in many instances, the effect of over-use in decreasing power.

Gymnasium training as practiced in many places is open to the same objections which apply to athletics, attention in some instances being localized on a few who are taught to excel in doing stunts on the apparatus, and in other instances the effort is made to make the subject feel the exercises, so that many of the class drop out from exhaustion before the completion of the period.

Development, of course, cannot be expected to follow lack of exercise, but it will follow a graded form of exercise, ceasing before the onset of fatigue, not too frequently repeated, and free from the cumulative endurance element. Development will decrease when the exercise is continually carried out to an excessive degree, the condition resulting from the burning up of the muscle tissue, the trained state of the athlete being a difficult one to maintain, owing to the precarious balance between the reproductive and destructive processes.

A more or less systematic plan of work was laid out last October to meet the altered conditions caused by the new compulsory gymnasium schedule. The previous year's work for the fourth class having proved somewhat unsatisfactory, attention was called to the Swedish System of Physical Training as used in the British Navy. These exercises were first tried out experimentally, and then beginning with the present fourth class last summer were gradually applied to the midshipmen.

The effect on the present fourth class, after a short period of work during the heat of summer, together with the result of the winter work, on all classes, as tabulated below, will no doubt be convincing.

TABLES OF COMPARISON RESULTS IN WEIGHT AND STRENGTH.

POSTURAL RESULTS, OCTOBER, 1911.

First class	41	% defective.
Second class	35	"
Third class	20.5	"
Fourth class	23	"

The results of the posture test showed the prevailing defects to be those of the student (head drooping, upper chest flat, and abdomen protruding (sway back)). Many presented a lowered right shoulder due to slouching or yielding in the spine under the weight of the rifle from too frequent carriage at "Shoulder-Arms." The effect of poor posture is to cramp the action of the heart and lungs, and as a result deficient oxidation takes place, this affecting metabolism within the body.

The April test disclosed that with one or two exceptions in each class all midshipmen could assume the position of correct carriage of the body, the effect (even in mature individuals) of the Swedish exercises being very pronounced in developing the chest, in loosening the joints, in stretching contracted muscles, and in

adjusting the spine. Correct posture is not yet a habit, however, and some method (now lacking) must be devised to counteract the constant assumption of poor position during the numerous study and recitation periods daily, which tend to overbalance the good effect coming from the limited military and gymnasium drills.

RESULT OF OCTOBER STRENGTH TEST ARRANGED IN PERCENTAGE ACCORDING TO NUMBER OF DEFECTS.

	Qualified.	1 1 to 5 defects.	2 6 to 10 defects.	3 11 to 20 defects.	4 Over 20 defects.
First class.....	27.5	39.6	8.7	13.8	10 4
Second class.....	31.2	48.9	6.1	9.6	4.2
Third class.....	34.7	47.0	1.1	9.2	8.0
Fourth class.....	31.5	32.7	10.9	10.1	14.8

FOURTH CLASS COMPARISON (SUMMER'S WORK).

		Qualified.	1	2	3	4
Allowance Standard	On entrance.	4.5	8.3	15.3	13.7	58.2
	October.....	31.5	32.7	10.9	10.1	14.8
First class Standard	On entrance.	1.6	2.0	4.1	9.9	82.4
	October.....	9.0	11.2	15.5	17.2	47.1

Remarks.—Midshipmen having 1 to 5 defects in strength were assigned one hour's extra gymnasium drill weekly until qualified. Those having more than 5 defects were assigned two hours' extra drill weekly. The classification is made on height with an allowance to lower classmen of one, two, and three inches, to permit of progressive development and allow for youth.

Of the 479 midshipmen who failed to qualify in strength last October but 30 remain (May) and these have minor deficiencies.

The following table shows the weight and strength results at the different tests for various classes:

Class	Average weight Oct. 1910.	Average strength Oct. 1910.	Average weight Oct. 1911.	Average strength Oct. 1911.	Average weight April 1912	Average strength April 1912	Pounds gain in weight 1911-1912.	Pounds gain in strength 1911-1912.
1912	145.0	4556	144.9	4641	149.3	5097	4.4	456
1913	142.7	4512	147.8	4684	150.1	5167	2.3	483
1914	135.8	3923	145.0	4612	149.5	5017	4.5	405
1915	[1]135.2	[1]3900	142.6	4390	[2]145.5	[2]4808	2.9	418

[1]On entrance 1911. [2]Represents about 10 months' development.

The following is to be noted in connection with the above results:

The ten classes 1900-1910 averaged in weight:

On entrance	132.6
As second classmen	146.5
As first classmen	145.4[1]

[1] A loss of 1.1 lbs. during first class year.

Comparison results in strength cannot be determined because of different systems in use, such results as could be determined showing an actual or relative decrease in strength during the senior years such as occurred in connection with the upper classes, 1912 and 1913 (see above). This decrease has been due undoubtedly to smoking and other privileges and to lack of sufficient physical drills.

The only drills hitherto affecting upper classmen in a physical way since the Spanish war, when the sailing cruises became more or less a thing of the past, are the disciplinary drills. All other drills have for these classes become mental in type rather than physical exercises. Weaker members of these classes for the past three years have been assigned about 16 hours gymnasium drill.

The question of arrival at mature development is often brought up as an excuse for the poor showing of the upper classmen. The result of the April strength test based on a minimum amount of gymnasium work the past winter has demonstrated a substantial average gain in weight and strength for these classes.

The present class of 1912, from October, 1910 to April, 1911, while second classmen, gained on the average 1.3 lbs. This gain disappeared before October, 1911, showing the characteristic tendency toward loss in weight of all previous first classmen. Under compulsory gymnasium drill this Academic year for the first time, this tendency toward loss has been nullified, and a gain of 4.4 lbs. recorded.

The average gain in weight and strength for the present third class from entrance in 1910 to October, 1911 (1 year and 4 months), was respectively 9.2 and 689 lbs.

The average gain in weight and strength for the present fourth class (10 months) has been respectively 10.3 and 908 lbs.

Those midshipmen who lost in weight and strength the past year can be placed under three classes: The largest number en-

gaging in strenuous athletics; a smaller number as members of the strong squad (few compulsory drills) apparently took no voluntary exercise, and so suffered from lack of work; and the fewest were those of frail physique, who are under weight for age and height.

The following shows the percentage results based on number of defects for comparison with the results of the October test (see above):

	Qualified.	1 to 5 defects.	6 to 10 defects.	11 to 20 defects.	Over 20 defects.
First class	85.5	11.2	1.9	0.7	0.7
Second class	90.3	6.9	2.1	0.7	0
Third class	95.1	4.9	0	0	0
Fourth class	93.5	5.5	1.	0	0
Fourth class compared with First class Standard.	33.8	42.3	14.4	8.5	1.

The following is arranged for general information in connection with the Swedish day's lessons and the description of the exercises which go with them. The exercises have been taken from the "Handbook of Physical Training" (British Admiralty) in use at the Naval Academy. A few additional exercises are described, requiring simple apparatus, and which can be substituted, if such apparatus is available or can be improvised, for the free standing "Span Bending" and "Heaving" exercises.

Each exercise has a title: "Standing: Heel Raising." The first part of the title denotes the starting position from which the exercise is done; the second part, the part of the body which is moved. The title is intended for the information of the instructor, but when the exercise is not well understood the second part may be announced as a preliminary *preparatory* command. Commands are of two kinds as indicated on page 357 of the "Landing-Force and Small-Arm Instructions, United States Navy, 1905."

Do not exercise just before a meal or within at least one hour after a meal (digestion will be interfered with otherwise).

The best time for exercise of any kind is between the hours 10 and 12 morning, and 4 and 6 afternoon. The Swedish exercises can be performed before breakfast, or even at bed time.

It is a mistake to eat a hearty meal before physical or mental work. The more food in the stomach the more mechanical inter-

ference in the neighborhood of the heart, and the less blood circulating in and purifying the organs affected by the exercise.

Exercise should preferably be done in the open air, and in the sun if not too warm. If indoors the room can go as low as 50° F. in temperature, and there should be free ventilation.

A loose light woolen garment should be worn to prevent too rapid radiation of heat. The clothing should be clean and should not be that used for daily wear.

The Swedish day's order is arranged to give the body a general warming up series of movements before the more strenuous effects, and at the end there is a tapering down series for a calming effect. In all exercise graduation should be practiced so as to accustom the parts and organs to the strain. In cold weather, especially, the muscle fibers can be torn easily if too much strain is applied before they have been warmed and loosened up.

In paired exercises begin with the left side, if right handed, or vice versa.

In the Swedish system there is little danger of producing fatigue (other than local), but it is best even here to cease exercising if fatigue is a prominent symptom. The fatigue meant is that due to exhaustion and not stiffness or soreness. Immature and older subjects should be careful not to exercise to excess.

Exercise should improve health, control, strength, proportion, and posture. If large muscles are sought the subject becomes less agile through limitation in response and range of motion. The large masses of tissue, furthermore, require abnormal nutrition and in the end tax the subject's vitality to a marked degree.

If breathlessness or heart palpitation appear cease exercising, and make slow leg movements, or lie on back with arms and legs stretched loosely apart and breathe deeply. Practice a breathing exercise. Any organic disease of course contra-indicates most forms of physical exercise.

Form is particularly necessary in carrying out any exercise, especially a Swedish exercise, departure from the designated method of performance in many instances nullifying the effect. It is better to do one movement in good form than several in bad form.

Make it a practice to relax the muscles not in use so as not to antagonize one muscle by its fellow of contrary action. Many men waste an enormous amount of energy in fighting their own

effort ("muscle bound"), thus making themselves slow, jerky, and clumsy, besides lessening their power of endurance by quickly forming within the blood an excess of waste combustive products.

Food replaces that which is lost within the body cells in the production of energy. Foods are of three kinds: (1) Proteid (white of egg, lean meat). (2) Carbohydrate (starch (potato, rice), sugar). (3) Fats (butter, olive oil). Briefly, the first forms flesh and the second and third are converted into heat, or stored up as fatty tissue.

As a rule the average man eats more than is needed and as the excess must be eliminated or stored up, the body cells are overworked to no good end and general vitality is by so much lowered.

No particular diet is necessary for even strenuous physical or mental labor provided moderation is practiced and ordinary precautions are taken in the selection of food, its proper preparation, the interval between meals, and avoidance of haste and deficient mastication in eating it. As mentioned before little or no food should be taken before work. It is the food of the day previous which furnishes fuel for the production of energy.

In warm weather less heat producing food is required.

Certain idiosyncrasies must be respected.

Persons with loose skins, the result of former excess of fatty tissue, are apt to vary greatly in weight (a loss of ten pounds from free perspiration after fairly violent exercise in warm weather being not uncommon).

During exercise water should not be taken as it has a mechanically bad effect on the heart. Rinse the mouth only. Await a sufficient interval after exercise before drinking freely.

Persons inclined to stoutness should exercise freely and diminish the fat producing foods. Restriction in the water supply is not a good plan as water is needed to carry away the ash formed from the combustion going on in the production of energy.

A certain amount of fat is needed as a reserve food supply, and when it is sufficiently removed so as not to mechanically interfere by its pressure or weight the subject should be satisfied.

Stimulants and tobacco do not go well with exercise.

Excessive mental work and excessive physical work do not go well together.

Sleep is necessary so that the overworked cells can have a chance to recuperate and replenish their fuel (food) supply.

A cold shower bath should follow exercise while the body is still warm and covered with perspiration. Hand friction should be applied to the skin at the same time. If the shock is too great start with a tepid shower and end with a cold one.

Warm baths should only be taken for cleansing purposes and at bed time (calming effect).

THE SWEDISH SYSTEM.

In general the object of any form of exercise is to create a condition of improved health, physique, muscle control (co-ordination), self reliance, courage (coming from the knowledge of ability that good muscular action brings), alertness of perception, quickness in response both mental and muscular, erectness of body, symmetry, endurance, etc.

The four distinguishing points of the Swedish system are:

1. The day's order.
2. Progression.
3. The use of the word of command for movements instead of imitation.
4. Insistence on form.

The day's order.—The exercises of the day's order are arranged so as to affect the body in a progressive way, the classes of movements following each other with but slight modification, always in the same way.

1. Introductory exercises are designed to give a light work-out for the entire body, to get the blood circulating and to loosen up the muscles and joints. They consist of movements for formation of the class, dressings, facings, openings, etc., exercises to correct posture, and easy exercises already well known.

2. Leg exercises are designed to stimulate the circulation of the lower extremities and prepare the body for the stronger Span Bend and Heaving movements. After exertion slow leg movements by bringing blood to these parts exert a calming effect on the respiratory and heart action.

3. Span bending exercises develop the upper dorsal (back) muscles and stretch the anterior chest muscles. The stretching effect counteracts the cramping and fixation effect on the chest of the anterior muscles, brought about by excess of work on ordinary gymnasium apparatus, certain forms of manual labor, and bad posture (school children, students). The separation of the

ribs which takes place keeps the chest supple and mobile and thus favors lung expansion.

4. Heaving exercises are designed to aid in the production of a good carriage, proper form as to the carriage of the chest and head being of more importance than the number of times one can pull up.

5. Balance exercises are designed to affect the nervous system and its relation to co-ordination. Attention is required at first until the antagonistic muscles are trained to work together, after which the process becomes an automatic one and the subject acquires the habit of moving with an easy carriage and perfect control, using the minimum amount of energy, with consequent less fatigue.

6. Dorsal exercises are designed to affect all the muscles of the spine, thus aiding in extension of the body and consequent erectness.

7. Abdominal exercises by strengthening and improving the tone of the abdominal muscles prevent a tilting forward of the lumbar spine (hollow back), a prevalent condition. They benefit the digestive organs.

8. Lateral exercises affect both sides, contracting one and stretching the other. The ribs are separated and the chest made more supple and resilient. The abdominal organs are benefited. The spine is made more flexible and any tendency to spinal curvature obviated. They give suppleness to the carriage of the body.

9. Jumping and vaulting exercises require control and develop judgment, presence of mind, quickness of movement, resource, courage, and the ability to turn a quickly formed idea into action. They accustom the person to using just sufficient muscular action and no more, and exhilarate the nervous system. Good form is of more importance than length or height overcome. Free movement and lightness in "Taking off" and "Landing" is necessary.

10. Breathing exercises are intended to exercise the muscles of respiration and mobility of the chest. They should be used only after the breathing is somewhat under control (light leg exercises being used first). Three times at one time is sufficient; and they may be employed at any time when the breathing has been disturbed.

11. Marching and running exercises aim to educate the body to a free and easy movement of the hips, lifting and placing of the

feet, and to improve the carriage. The progression in running should be very gradual, the duration of a run never to exceed 5 minutes. This will gradually cause the heart and lungs to adjust themselves ("wind") so as to work together economically. The pace in running should be no more than a dog trot at first and even at the end.

12. Finishing exercises are light exercises already known with a preponderance of slow leg movements, and breathing exercises, with the object of calming down the nervous and circulatory excitement following the more violent movements. They tend also to act as correctors of posture.

Progression.—No exercise should be performed as a rule more than four times, and the most violent only once. A change from an easier to a harder exercise should not be made until the easiest is done in good form.

Word of command.—Use of fixes attention, and sets up nervous impulses to the muscles concerned which are a direct response to an effort of the will and not reflex or automatic in character.

As an example of the effect of mental concentration on a muscular movement it is to be noted that the muscle group directly concerned in throwing the leg forward in walking or running is the only group in the strength test applied to midshipmen which proves to be stronger on the average on the left side than its fellow of the right side. This excess of strength is brought out undoubtedly by the necessity of stepping forward with the left foot first in all military formations.

Form.—General faults in form consist in holding the breath during the performance of an exercise; contracting the chest by a bad carriage of the head, neck, and shoulders; or performing the exercise unevenly or incorrectly. Other faults are described in the description of each exercise. The performance of an exercise in good form influences to a marked degree the effect. An apparent easy exercise in bad form becomes a difficult one when done in good form.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SIMPLIFIED METHODS OF COMPASS CORRECTION.

By LIEUTENANT R. A. KOCH, U. S. Navy.

The method, which is here to be described, has worked successfully for two years with the compasses of the *Castine* and all the submarine flotilla. The German and Greek letters, ordinarily used, are here done away with, and thus the biggest bugbear of compass work is eliminated, the constant A being the only coefficient given real consideration in this method.

We consider that any compass is properly corrected when a distant object can be made to have the same compass bearings for all headings of the ship.

TO COMPENSATE THE COMPASS.

Note the change of bearing of the sun for every twenty minutes, using the azimuth tables, the approximate local apparent time, the latitude (correct to a degree), and the date of the month as arguments. A curve of the sun's change of bearing is then plotted on cross-section paper. A reference to the azimuth tables shows that an error of a few minutes in time, of a degree in latitude, or even of a day or so in date, make practically no change in the rate of change of bearing of the sun; though, of course, with such erroneous data there is a decided error in the actual bearing of the sun, but with the actual bearing we are not now concerned.

Problem.—Correct all compasses of a vessel, and swing for residuals in latitude 40° 20′ N., λ 70° W., about 3.00 p. m. on October 30.

Procedure.—1. Set watch to local apparent time approximately. For example, if watch had been keeping 75th meridian mean time, as would be probable, set it ahead twenty minutes, thus making it 70th meridian mean time, and then apply the equation of time.

2. Pick out from the azimuth tables, using 40° as latitude, and the column nearest the day of month—October 31—bearings of the sun at 20-minute intervals, viz:

Time.	Bearing of sun.	Change of bearing per 20 minutes.
3.20	106° 10′	.....
3.40	102° 14′	3° 56′
4.00	98° 34′	3° 40′
4.20	95° 05′	3° 29′

Using cross-section paper, taking ordinates as times, and abscissæ as degrees—unnumbered as yet—now draw in the curve *ABC* (see Fig. A).

3. Now head the ship north. Using the azimuth circle take a very accurate bearing of sun; in this case it equals 246° 30′ at 3.22. Put the helm over and swing to south. Plot point *X*, with this data, on Fig. A, close to the change of bearing curve, now marking the degree line at *A* as 246°, and also giving values to the abscissæ.

4. Steady on south. Bearing of the sun is found to be 245° 30′ at 3.29. Plot this as point *Y*. Draw *XX′* parallel to *ABC*. *X′*, therefore, represents the sun's bearing if headed on north at 3.29. Now draw a curve parallel to *ABC* and through the point *Z*, which is half way between *Y* and *X′*.

5. Now, using watch and curve, raise or lower the athwartship magnets until sun bears as it should. Then there will be no deviation, and south by compass will be correct south. All the other compasses are then made to read south in the usual manner.

6. Correct on east, and then on northeast in the same manner.

7. Head the ship north. If there is a difference in bearing from curve, one-half of this is deviation. Plot point, and, swinging on every fourth point, plot differences and draw curve through the mean of points. Those points to the left then are westerly deviation, those to the right being easterly.

If, however, there is a real constant magnetic error, it is not known by the above method, it is not and should not be taken out on one heading, as the error due to it would then be doubled on the opposite heading. The navigator's error is quite frequently the constant which makes the work check.

Now, to find the constant error, compute an actual bearing of sun and compare. For example, if the compass error at 7 a. m., and again at 10.30 a. m., on the same heading, is exactly the same,

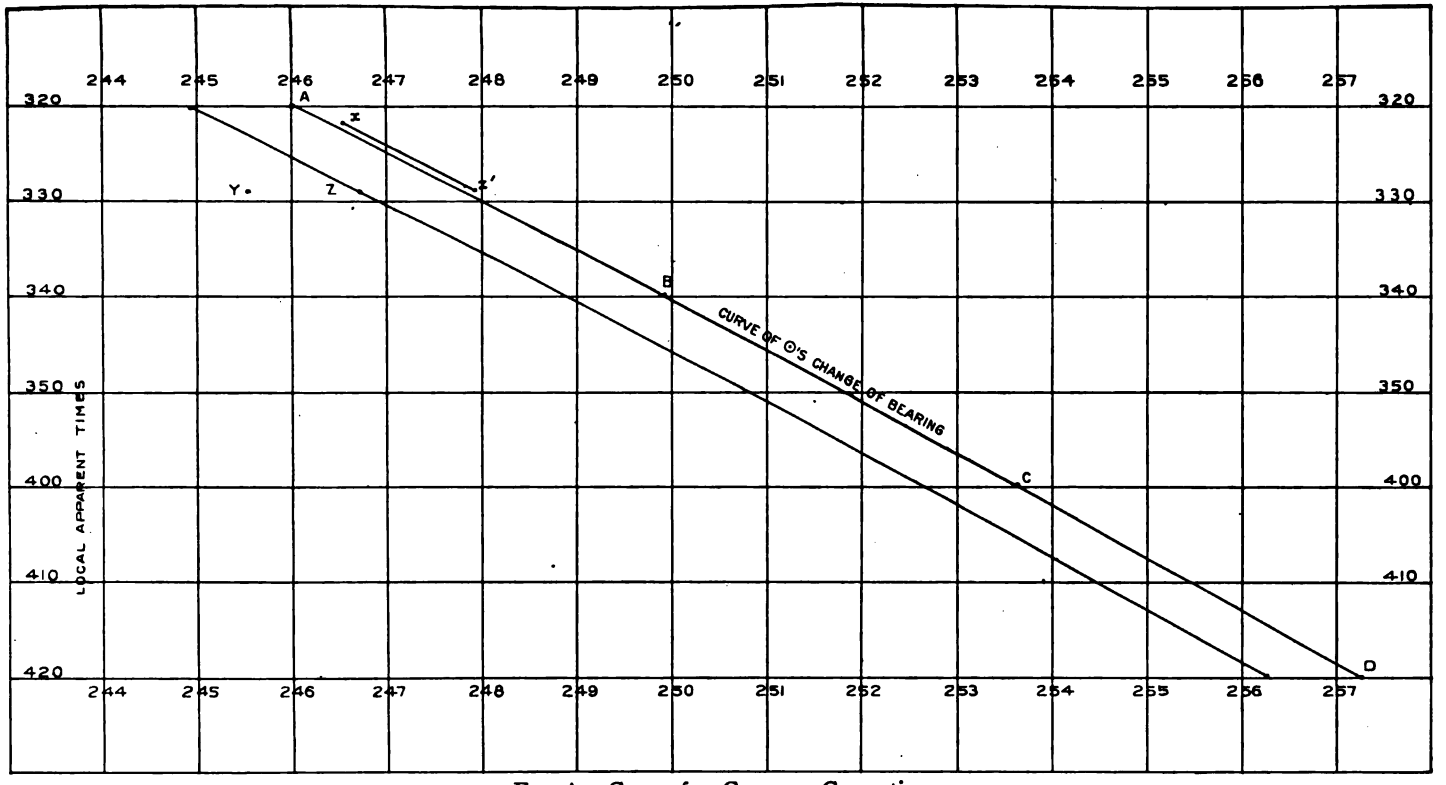


FIG. A.—Curve for Compass Correction.

Ordinates, Approximate Local Apparent Times. Abscissæ, Azimuths in Degrees.

it is safe to assume that there is no instrumental error and the constant error can be calculated. An instrumental error frequently found is that of the azimuth circle, *i. e.*, the mirror may read accurately on one angle and not on another. When correcting a compass in the usual method by a calculated bearing of the sun, this instrumental error and all errors in calculations give a false constant A. During the short time to correct in the above method—less than one hour—the angle of change of the mirror, or change of its error, should be very little, and, even if the mirror were in error *ten degrees,* the compass would be correct, because the distant object has been made to bear the same all the way around.

Whereas we know that in the usual method the compass would be corrected to take out the whole error (true constant A, instrumental and magnetic) on one heading, and on the opposite heading the instrumental error and plus true constant A error which should not have been taken out will be doubled.

It frequently occurs that an azimuth circle is in error by 2° after it has knocked about ship for a few years.

MATHEMATICAL NOTE ON THE ABOVE BY COMMANDER G. R. MARVELL, U. S. N.

$$\tan \delta = \frac{A' + B' \sin z + C' \cos z + D' \sin 2z + E' \cos 2z}{1 + B' \cos z - C' \sin z + D' \cos 2z - E' \sin 2z}.$$

The above is the strict mathematical formula for the deviation, z being ship's head magnetic. If the deviations are less than 20°, this formula can be reduced to (see Muir, p. 121):

$\delta = A + B \sin z' + C \cos z' + D \sin 2z' + E \cos 2z'$, where z' is the ship's head per compass.

Let $z' = 0°$, then $\delta_0 = A + C + E$.
Let $z' = 180°$, then $\delta_\pi = A - C + E$.

$$\frac{\delta_0 + \delta_\pi}{2} = A + E. \qquad (1)$$

Let $z' = 90°$, then $\delta_{\pi/2} = A + B - E$.
Let $z' = 270°$, then $\delta_{3\pi/2} = A - B - E$.

$$\frac{\delta_{\pi/2} + \delta_{3\pi/2}}{2} = A - E. \qquad (2)$$

Let the compass be compensated on N., S., E., and W., and the coefficients B and C have been reduced to zero. Therefore,

$$\delta = A + D \sin 2z' + E \cos 2z'.$$

Let $\delta = 45°$. $\delta_{\pi/4} = A + D$. (3)
Let $\delta = 135°$. $\delta_{3\pi/4} = A - D$. (4)
Let $\delta = 225°$. $\delta_{5\pi/4} = A + D$. (5)
Let $\delta = 315°$. $\delta_{7\pi/4} = A - D$. (6)

An inspection of these last show that to compensate for D, (3) and (4), (3) and (6), (4) and (5), or (5) and (6), are the combinations.

TO SWING FOR RESIDUALS.

If deviations are small, say not over one-half point, then the "lag" of the compass will be constant, if the swing of the ship is constant. Note the change in bearing of sun during 10 minutes. Plot curve of the change of bearing of sun for this time. Start vessel swinging and, after it has swung through 8 points, consider the swing constant.

Example.—1. With data, as in first case, we find the change of bearing from 3.50 to 4.00 to be 2°. Plotted curve *AB* (see Fig. B), and without designating values for ordinates or abscissæ.

2. Headed east and put helm hard to starboard. Follow the sun with the azimuth circle. When passing north, took azimuth and time—*i. e.*, 268½° at 3:51. Now, in Fig. B, mark 268° for abscissa at point *A* and 3:51 for ordinate, and plot N.

3. Took bearings every fourth point and plotted NW., W., SW., S., SE., and E. From the mean between N. and S., E. and W., NW. and SE., and NE. and SW., draw curve *XY*. By mean is here meant the mean of the opposite cardinal points, or adjacent intercardinal points. Or, this may be drawn from the mean of only north and south, and still be approximately correct.

4. The amount the points vary from this line is the deviation, plus any known constant the compass may have. The result is shown in Fig. B.

Thus, in the above method, we did not need to know the magnetic bearing of the sun (any distant object could have been used), because the bearing used was the magnetic plus the lag plus the constant.

The above method has been proved by trial on various ships with corrected compasses, using uniform speed and helm. The bearing of the sun remained constant, or only varied an amount equal to the change of sun bearing due to time, the bearing being in error the lag.

NOTE ON "LAG" OF COMPASS BY COMMANDER G. R. MARVELL, U. S. N.

The mean directive force of earth and ship in terms of earth's horizontal force as unit is represented by λ, which depends for its value upon the effect of horizontal soft iron, symmetrically arranged about the compass.

Therefore, for any particular heading of the ship there is a certain pull or force on the needle, tending to draw it away from the magnetic meridian, and to bring it to rest at compass north. On another heading there is a similar force, but of different value. If a ship is swung with a constant

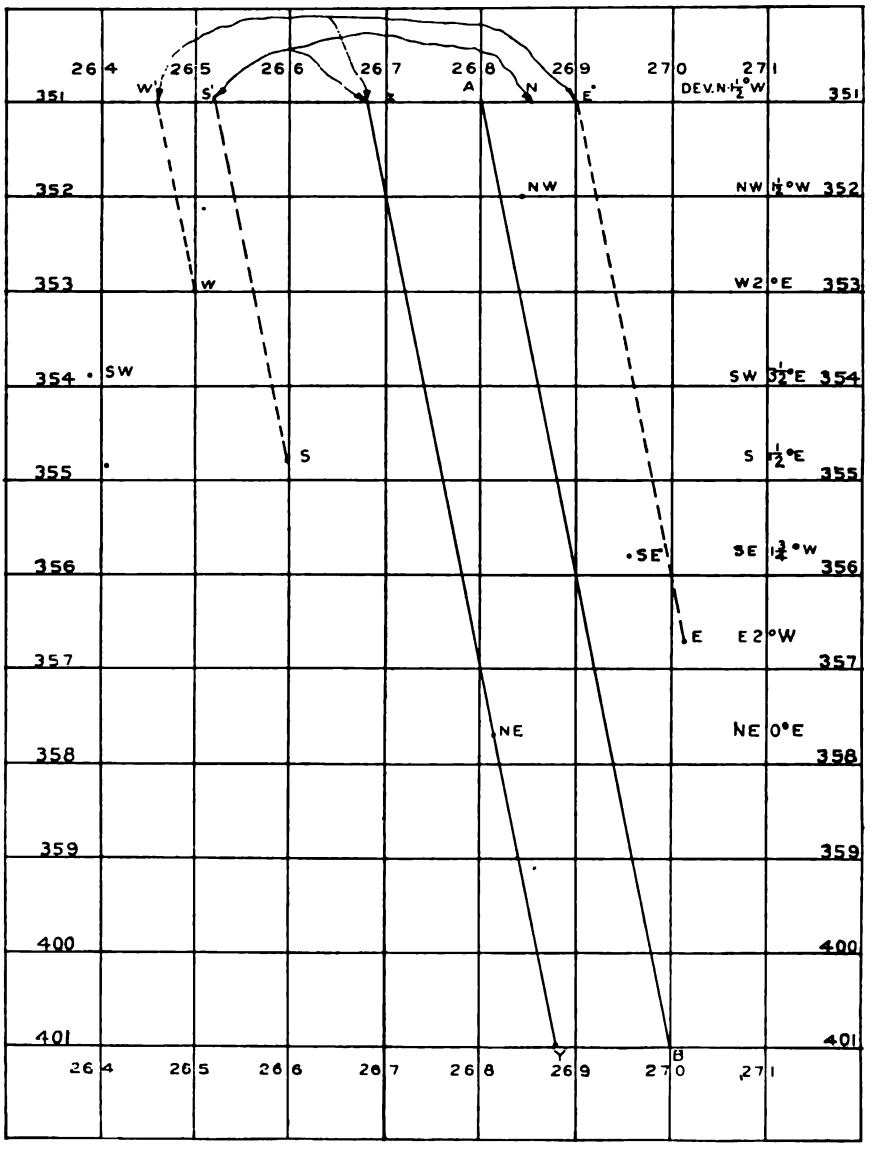


Fig. B.—Curve Swinging for Residuals—Hard Over Helm.

change of magnetic azimuth, the compass needle will be acted upon by a varying force, so that at any particular magnetic head the deviation will be different from what it would have been if the ship had been steadied on that magnetic head. This difference in deviation may be called "lag." If the force acting on the compass needle was constant, and the angular velocity of the swing was constant, then the lag would be constant. But in an uncompensated compass the force is variable, therefore the lag is variable.

By the method of compensating described above, the compensation on N. and S. gets rid of C, but leaves A and E; the compensation on E. and W. gets rid of B, but leaves A and E; that on NE. and SE. gets rid of D, but leaves A. The value of the force of earth and ship to magnetic north is given by the formula

$$F = \lambda(1 + B' \cos z - C' \sin z + D' \cos 2z - E' \sin 2z).$$

This in terms of earth's horizontal force as unit.

Assume that B', C' and D' have been eliminated by compensation, and the value of $\lambda + E'$ with correctors in place has been found, then the formula reduces to

$$F = \lambda(1 - E' \sin 2z).$$

If E' is very small, as it is in all centrally located compasses, then the value of F practically remains constant, and therefore the lag is constant.

If the compass is out of the midship's line, and the rods d and b have effect, then the method of compensation, and of finding residual deviations given above is faulty and should not be depended upon.

However, if the deviation has not been entirely removed, the lag will not be constant, for there will remain values for B', C', D' and E', which, when substituted in the formula for force, will give varying values of that force.

The amount of difference in the lag cannot be stated; it may, or it may not, affect the finding of the correct deviation.

TO CORRECT COMPASSES—NO INSTRUMENTS EXCEPT AZIMUTH CIRCLE. NO TABLES OF INFORMATION OF ANY KIND.

1. Steady ship on one course; note bearing of sun and, again, about 10 minutes later; from these two bearings one can tell whether the bearing is increasing or decreasing, and approximate rate. In this case it is noted that the bearing is increasing between 1° and 2° every 10 minutes. Call it about 10° for every 7 minutes. If no watch is available, note approximately the number of revolutions for 1° change in bearing. All that is necessary is some very rough method of measuring time, and even this is hardly necessary for accurate work.

2. Procedure: Head north; sun bears 270°; head south, steady about 2 or 3 minutes; sun bears 276°; time interval about 6 minutes. Six minutes sooner the bearing would have been 275°—

the average is 272½°—in 6 minutes, therefore, the bearing would increase 1° and the sun should bear 273½°; so raise or lower magnets and, as a little time will be consumed in this operation, make sun bear between 273½° and 274°. Head east and west, same procedure. Head northwest, then southwest, and follow the same procedure.

On southwest or northeast the natural deviation is east; if it is found to be west the compass is overcorrected and it is necessary to move balls out. On northwest or southeast natural deviation is west; if found to be east, then compass is overcorrected and we must move the balls out. If the above cannot be remembered, simply move the balls and find out what happens.

Now put the helm hard over and, after swinging through eight points, take bearings every fourth point, and proceed as in the method of swinging for residuals, with hard over helm. If the work was accurately performed, it will be found that the bearing all around will be the same, or about ½° more by the end of the swing, due to change of bearing of sun in the time interval.

FLINDERS BAR CORRECTION.

1. Being on the magnetic equator correct compasses, after going north, a deviation is observed. Using rectangular method of Flinders bar, take out this deviation. (In general, it will be found that either a very weak or no Flinders correction is required on the side of the compass.)

2. The vertical magnetic force varies as the sine of the magnetic latitude, or, to express it differently, the vertical magnetic force varies as the sine of the dip. In latitude 14° 31′ north, corrected compass, sine of 14° 31′ equals ¼ (no Flinders bar in). In latitude 30°, noted deviation on east course equal 2° W. Sine 30° equals ½. Place Flinders bar ahead of compass, add rods until deviation is 2° E. Similar procedure on north heading.

3. The pull causing the deviation in latitude 30°, sine ½ is twice as much as the pull in latitude 14° 31, sine ¼; so the deviation caused by vertical force, or caused by the magnetism in vertical soft iron, is twice as much in latitude 30° as in latitude 14° 31′. The actual deviation caused by vertical soft iron in latitude 14° 31′ is thus 2° and in latitude 30° is 4°. The compass must then be changed 4° by Flinders bar, but, having been corrected with magnets in latitude 14° 31′, there is now a deviation of 2°; this is to be taken out by correcting with magnets in the usual way.

While this method of Flinders bar correction has not been proved by actual trial, it is believed to be correct.

NOTES.

When first beginning compass work the author started with a carefully worked out magnetic curve, but nearly always found that, after compensating on north, the sun's bearing on south was not according to the curve. So, judging this due to mathematical, instrumental variation, or a constant magnetic error, a curve was drawn half way between the worked out curve and the south compass bearing, and it was found that this curve could be followed all the way around. Then a curve of proper shape only was found to be all sufficient.

If the compass tray is immovable, wires can be added, but do not do so by the bundle; magnets can even be nailed to the deck. It has been found beneficial to have the compass balls annealed by heating to a dull red and cooling slowly over night, about every six months, as they collect a little permanent magnetism.

The above methods are certainly simple, easily taught, form a practical method of compass correction, and eliminate the difficulties ordinarily met with in this work.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AVIATION IN THE NAVY.*

By LIEUTENANT E. LAPOINTE, French Navy.

Translated by ASST. NAVAL CONSTRUCTOR JEROME C. HUNSAKER, U. S. Navy.

PREFACE.

In spite of the daily feats of the aviators, there are still a great many men who will not admit that aviation can ever have a practical application, and I have often seen all argument in favor of flying machines meet with hostile incredulity or absolute denial.

But this is not surprising when we consider such predictions as these:

> "A steamer will never cross the Atlantic;
> The bicycle can serve only rare acrobats;
> Horseless carriages will never be practical."

How few years it is since results have given the lie to such pessimistic prophesies! Such manifestations of the law of inertia retard progress and can become prejudicial and even dangerous. This paper is an attempt to combat this tendency and to create in the navy that favorable atmosphere, without which a new invention makes slow progress.

The advantages that the navy may expect from aviation are great indeed, but before discussing them, I wish first to establish the possibilities of flying machines of the present day and the very near future. The latter could be easily defined if we could calculate the reactions upon oblique plane or curved surfaces, moving through air. Or again, if there existed some formula by which we could describe with numerical quantities a flying machine to fulfill given conditions. But the problem is analogous to the design of a war ship, and does not admit of a direct or "a priori" solution. Nevertheless, our designers succeed in building excellent ships; and there are already successful flying machines, and better ones still will be developed by attention to the following principles: Careful study

* Librairie Militaire R. Chapelot & Cie., 30 Rue et Passage Dauphine, Paris, 1910.

of experiments already made, precise observation of the flight of birds (which give us perfect experimental models), application of the principles of naval architecture to aeronautics, and the pursuance of methodical tests suggested by theories, which, even if tentative, will be successively more fruitful and nearer truth.

The scope of this paper does not include a history, however brief, of the experiments in aviation up to the present day, nor a treatise on aviation. But to facilitate a critical and comparative study of flying machines of different types, I will give a discussion of the governing principles.

ACTION OF AIR ON SURFACES.

Coefficient k—Center of pressure—Equilibrium and stability of aeroplanes.

If a thin plane move uniformly through a fluid at rest, or if this plane be held stationary in a uniform current in which each particle moves in a parallel path in the same direction, and if we assume the plane and the fluid to be perfectly elastic, and finally if we assume that each particle of fluid disappears after having exerted its action on the plane—then with these assumptions we may write (after Newton):

$$P = kSV^2,$$

"P" being pressure in the direction of the current; "S" the section of the column of fluid intercepted by the plane, or the projection of this plane on a plane normal to the direction of the current; "V" the uniform velocity of plane or fluid; and "k" a coefficient given by

$$k = \frac{d}{2g}$$

when "d"=density of fluid, and "g"=acceleration of gravity.

For air of density 1293; $k = .065$, and expressing velocity in meters per second, and surface in square meters, the pressure will be in kilograms.

The theoretical formula is true, not only for a thin plane, but for any surface—normal, oblique, plane, convex, concave, large or small, circular, square, rectangular, rough or smooth—under the expressed condition that the above assumptions are made. It is precisely because these assumptions are neglected that we have interminable and futile discussions of the coefficient k. Air is not perfectly elastic, and besides being viscous, does not disappear after

having impinged upon a point of a surface, but reacts upon the neighboring air particles. In practice, the formula $P=kSV^2$, on which is based all the theory of aviation, has little value, and can be used only with caution. Confidence in this formula has caused many an aviator to lose his time and money, and sometimes his reason.

Numberless experiments have been made to determine a "practical coefficient k," but without success except in the most simple cases. Certain writers have attempted to introduce a new coefficient; others have proposed fractional exponents not well defined, and still others have added corrective terms of more or less complexity.

We have the following:

$$P=k\lambda SV^2$$
$$P=k\lambda S^\alpha V^\beta$$
$$P=A+BV^\alpha+CV^\beta+\ldots.$$

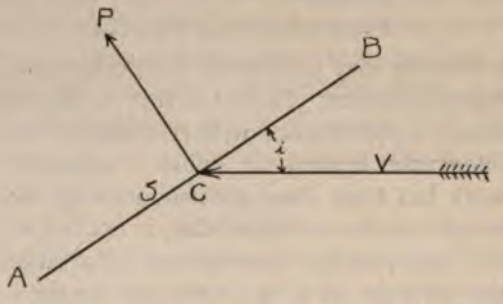
All such formulæ may conform to particular cases, but are not suitable for generalization. Plotted as curves, they represent, more or less precisely, a phenomenon with restricted limits, but exterpolation or integration beyond the limits is impossible. Much interesting work has been done without defining such limits, and though admirable to the mathematician, is not helpful and is often an obstacle to the practical development of aviation. This does not mean that formulæ are to be abandoned; on the contrary, more calculation must be brought into the design of flying machines. For this we require careful analysis of complex phenomena, and the determination of coefficients with precision, for practical formulæ. Such work can only result from methodical experiments in testing laboratories specially equipped, such as the several aerodynamic institutes founded already in France and abroad, from which much is expected. Even though aviators, disregarding for cause the unsatisfactory coefficient k, have constructed machines that fly well, they still wait for important improvements. Such improvements can only become possible through the work of the theorists, just as the first aeroplane was the result of the theoretical research of many men.

The following method is generally used in the study of the reactions on an aeroplane. Of all mechanical forces, inertia is most often neglected. Inertia introduces a resultant force and a couple, nearly always disregarded. The resultant force can be resolved

into two principal components, one vertical or sustaining, opposed to gravity, and one horizontal, nearly opposed to the movement of the machine. It has been attempted to determine the relation between these components and the resultant, and being variables, they have been expressed in curves the parameters of which are arbitrarily assigned. But since these parameters cannot easily be determined experimentally, there has been a natural tendency to neglect one or more, with the result that generalizations so made have been found disappointing.

An example may show this better, and we choose that one which forms the basis for all study of the aeroplane.

Given a thin rectangular plane "*AB*" inclined in a current of air of uniform velocity *V*, we will show how our problem is less simple than it appears.



If the theoretical conditions given above for the coefficient *k* were to hold, the reaction of the air on the plane would be of a magnitude determined by a function of *S*, *V* and *i*, in a direction normal to the surface, and applied at the center of figure. But in practice, particles of air striking the plane do not disappear, but react upon their neighbors. The stream lines of air are deviated at the forward and after edges as well as at the sides. An eddy is made on the forward face with an increase of pressure, and an eddy on the back with a decrease of pressure. The difference of pressure on the two faces leads some aviators to say that the back of the plane is more effective than the face exposed to the wind; but when we consider a wing of material thickness, it is obviously necessary to consider the profile of each side. The wake left in the rear has a different section from the projection of the surface upon a plane normal to the direction of movement, and eddies exist along the edges of the wake.

Theorems of momentum and moment of momentum can be applied to aeroplanes and aeroplane propellers only with reservations which cannot be neglected, as is permissible for oblique surfaces moving through water.

Finally, it follows that the reaction upon the plane is not normal, but generally inclined forward, for small angles of incidence. The point of application, or center of pressure, is nearer the leading edge than the following edge, a most important consideration for equilibrium. The magnitude of the reaction is also very different from that indicated by calculation, but the true reaction, fortunately, is the greater, often by a considerable amount.

Even this incomplete analysis shows why study of the coefficient k is so deceptive. The direction of the stream lines is affected by the inclination at the leading edge; by the different inclination at the following edge; by the curve given to a surface; by the thickness applied to the back of such surface; by the dimensions of the surface; and by the relative force and direction of the wind. One can understand how it will require a long and varied series of experiments to establish a formula to give the magnitude and direction of the force of the air upon a surface in motion, and to determine the best profile for an aeroplane wing.

But it is not necessary at once to attack the entire problem. It will be expedient first to determine the best profile, basing the work on those characteristics which experience has shown to be of value. Surprising as it may appear, almost nothing of this kind has yet been accomplished. It is thought, for reasons more or less vague and often false, that a curved surface is better than a plane, and experiments have shown for the curved surface a greater sustaining power for less resistance. At ordinary angles of incidence, the center of pressure remains more nearly fixed in the vicinity of the center of figure for curved surfaces. But for very small angles of incidence, the center of pressure for a curved surface may suddenly shift toward the leading edge, endangering the equilibrium of the aeroplane.

Profiles following the arc of a circle have been very generally used, with a height of arc from 1/15 to 1/20 of the chord. Some constructors have given such thickness to the wings that the profile of the back and face are not the same.

The above analysis shows the great importance of the leading and following edges of the plane, and the conclusion is that in

choosing a profile for a wing of an aeroplane, careful study must be made of the influence of these edges with a view to regulating the cutting of air by the leading edge and the flow of air past the following edge. The stream lines must be made as easy and uniform as possible, and eddies or whirls must be eliminated or at least kept to a minimum.

Conclusions from observation of the flight of birds, from several significant experiments, and the comparison of certain forms for hulls of ships, permit us to suggest modifications to apply to the concave profile actually in use. There will certainly be a profile similar to Fig, 1 for the lower face; a concave part *BC*, following a curve which will not always be an arc of a circle; a convex part *CD*, raised forward in a manner to insure pressure always on the lower side and so avoid being taken aback; and a rear part *AB*

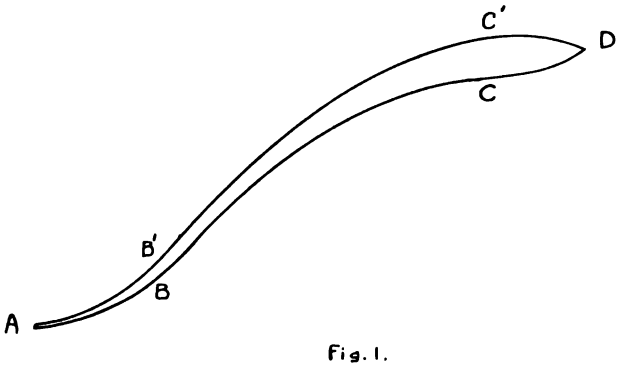


Fig. 1.

probably slightly convex. The relative importance of the sections *AB* and *CD* with respect to *BC* should vary greatly with the speed and with the size of the wing. And there will not be similitude between wings of only slightly different dimensions. The profile of the back *AB'C'D* must be studied experimentally with the face *ABCD*.

To avoid errors of exterpolation, the experiments should not be made on small models, and this restriction should affect the organization of aerodynamic laboratories. The method of testing in open or closed tunnel, however advantageous, becomes on this account impracticable, and we must resort to traction in still air with its obvious difficulties. The degree of precision obtainable in towing a full-sized surface at 30 or 40 meters per second even with a breeze of 3 or 4 meters per second, will be at least as great as one could claim for a tunnel experiment, where a reduced model is held

stationary in a current of air. Therefore, in the open air, without an immense hangar, we often can have a wind of less than 3 or 4 meters and can conduct very satisfactory experiments. Thirty meters per second may seem at first excessive, but already aeroplanes have made 17, 20 and even 25 meters per second, and with better profiles we may expect 30 meters velocity and over.

One of the first tests should be to tow in air, at a speed of 40 meters per second, elements of aeroplane wings, having various profiles, with full-sized width between entering and leaving edges, and of sufficient length to reduce the effect of air escaping from the sides. By measuring for each element tested, the resistance, lifting power, and pressure at various points on the back and face, we could shortly arrive at the best profile for any given speed and size.

So far, I have only discussed the efficiency of the lifting surface of the aeroplane—the greatest lifting power for the least resistance to propulsion. But if our aeroplanes of to-day need improvement in this respect, how much more is improvement required from a consideration of stability and equilibrium.

EQUILIBRIUM AND STABILITY.

Most writers, theorists as well as constructors, assume that an aeroplane is in equilibrium when the resultant of the weight and the thrust of the propeller is equal and opposite to the reaction of the air on the sustaining surfaces. However, this definition is obviously inexact because no account is taken of the forces of inertia, often most important. In fact, a static equilibrium is assumed, in place of an actual dynamic equilibrium. This error has retarded the solution of the problem of flight, and still hinders progress. Equilibrium, according to this theory, is to be secured by lowering the center of gravity. Practical operation of aeroplanes has shown that the system rocks about successive centers of pressure, as if according to a sort of metacentric curve. Such oscillations reduce the lifting power with reference to the thrust of the propeller, augment the resistance to propulsion, and may finally render flight impossible. There is danger in bringing the center of gravity too near the sustaining plane, because the slightest variation in the force or direction of the wind may produce a sudden change in the position of the center of pressure, and the machine will dive, or tilt up vertically—a no less dangerous performance. However, such oscillations of the machine can be much reduced by making the center of pressure more nearly fixed in position.

Avanzini's formula and similar ones are no more exact than those which pretend to define the coefficient k, but it is known that the center of pressure moves along the middle line of a surface, from the mid point an indeterminate distance toward the leading edge. In any case, this displacement of the center of pressure is proportional to the width of the surface in the direction of flight.

It follows, that for a rectangular surface, this displacement is least when the surface moves in a direction normal to the longer side. It is in such a manner that birds and our successful aeroplanes utilize their sail area.

There are a few who still defend the wing with the long side in the direction of flight, but the advantages of such a rig are purely theoretical or limited to particular cases.

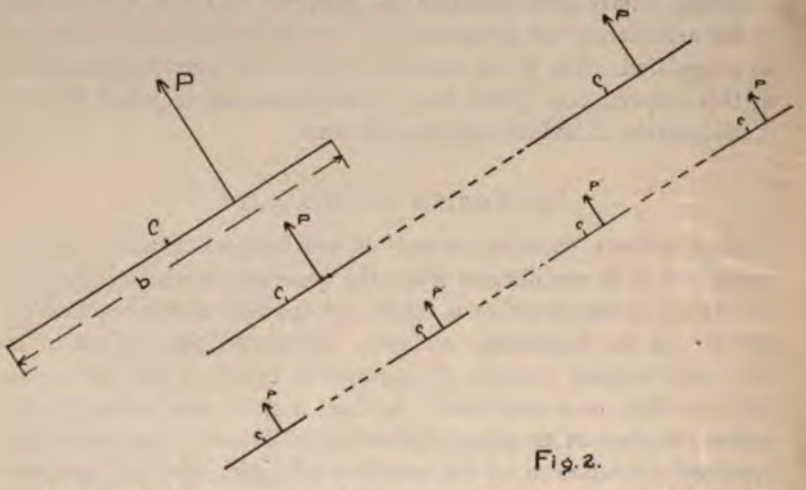


Fig. 2.

If we divide the surface into two parts placed one before the other, as in Fig. 2, the displacement of the center of pressure of each part (and hence of the resultant center of pressure of the whole wing) will be reduced by one half. And if we divide into N parts, the movement of the center of pressure is reduced to $\frac{1}{N}$ th of its former value. If, in addition, the surface of two sections have a wide gap between sections, the moment of inertia about a transverse axis is increased and the effect of the movement of the center of pressure reduced.

These considerations have suggested multiplanes. Good results may be expected from two pairs of wings, but further multiplication of surfaces has disadvantages which will appear later.

If, however, we attempt to fly models, made with two equal planes in tandem or with two biplanes of equal size, we will need to cut down the rear planes to a small fraction of the size of the forward plane. With such a tail remaining, we will have sufficiently reduced the oscillation of the center of pressure and its effect on longitudinal equilibrium. Some inventors have made this tail movable, to use as a horizontal rudder or depth governor. This is evidently a mistake, for we cannot expect such a rudder to act also as a sustaining plane. The tail should be stationary, although it may be of advantage to change its position to adapt the aeroplane for soaring without power "vol plané," or to carry very different loads. This, however, is a refinement not important at the present stage of development. Whether the tail shall be in the prolongation of the forward surface, or given the same inclination, are questions to be studied. There would seem to be an advantage, if the tail contributes to sustaining the weight, but some otherwise excellent designs have abandoned this claim in order to provide a necessary security against capsizing. This could be better accomplished in other ways, especially by raising the rear edge of the wings.

The tail or appendage has certain disadvantages. It adds to the complication of the machine, and is liable to be damaged in rising or landing; which operations it renders more difficult. In addition, the tail, with the necessary structure to connect with the principal surface, adds considerably to the weight and to the resistance to propulsion. Several well-known machines have almost no appendage, for their designers have provided a tail plane, smaller in area and much nearer the central structure than is customary in French practice. The result is an apparent simplification and handiness, but flight becomes more difficult and fatiguing.

The importance of the appendage varies inversely with the moment of inertia of the machine about a transverse axis. In the first aeroplanes and dirigibles, the value of the moment of inertia was too low, but that is not reason for us to exaggerate it. For, if a large moment of inertia diminishes oscillations, on the other hand, it becomes more difficult to check swinging started by any accidental cause. For example, the behavior of submarines has been improved by weighting the ends, while such a system of loading makes a ship pitch badly at sea.

A fixed tail should dampen accidental oscillations in the longitudinal plane, and a horizontal depth rudder cause the aeroplane to rise or descend. This rudder is nearly always placed in front, and

in such a position, contributes to sustentation. However, when the horizontal rudder is placed in rear, as in a few machines, there seems to be no loss in maneuvering power. This rudder is an important accessory and will undoubtedly be modified when we have determined upon the best wing profile. Its action should be partially supplemented by wings movable about a horizontal axis, by the simultaneous movement of ailerons, or by warping the wings. These three solutions are more or less completely in use at the present day, and when considered in connection with the vertical rudder, have an important effect upon lateral equilibrium; *e. g.*, with respect to a vertical axis.

This lateral equilibrium has small effect on a straight course, because of symmetry about a vertical longitudinal plane through the center of gravity. But in turning its study becomes most important.

A vertical rudder would seem to be the most logical means of steering, but the action of such a rudder, placed in rear, will disturb transverse equilibrium. The force of inertia enters here and must be considered. With the rudder inclined there will be a capsizing moment and a turning moment, which will not necessarily be the same as for a ship; for an aeroplane differs essentially from a ship in that the former is submerged in the element that bears it, the distribution of weight with respect to the different centers of pressure is entirely different and the vertical surfaces, which give stability of steering, are small.

In a study of steering, we have to consider the action of ailerons, placed at the extremities of the wings, or of warping the extremities of the wings to produce the same effect. The study of the combined effect of ailerons, or warping, with the vertical rudder, taking account of inertia forces, is easy to make, and though the results are qualitative, there is, in general, no uncertainty with regard to the direction of an effect caused by a given maneuver. Experience with these parts of the aeroplane is so extensive that there is small chance of radical change in future.

It is important to determine whether vertical planes shall be employed at all. Many machines do without them completely; sometimes such planes are replaced by a special configuration of the supporting surfaces, or by an inclination of the wings about a longitudinal axis. These arrangements have not all the virtues claimed for them and many of our best aeroplanes have their wings

not movable about any axis and without vertical planes. On the other hand, the vertical partitions used in certain biplanes serve to diminish the speed and, in consequence, the sustaining power. Such vertical surfaces should be reduced to a minimum, and stability of steering provided by a special conformation of the body and wings, without diminishing their principal function, that of sustentation.

Transverse equilibrium is most unsatisfactory in modern aeroplanes. In calm air, even when turning, the symmetry of the aeroplane prevents any great demand on transverse equilibrium, but in moving air it is of great importance. It is, in general, difficult to fly with the wind, because of insufficient transverse stability. This introduces the idea of stability as distinguished from that of equilibrium. Nearly all writers have confused these terms, and as a result they are now used synonymously everywhere. However, we may state that a system of forces in equilibrium is stable only when an external force, acting to destroy equilibrium, is resisted by the resultant of the system of forces in such a manner as to preserve that equilibrium. With rigid wings, an aeroplane oscillates more as the center of gravity is farther from the center of pressure. When these two centers are near together, as they should be, the stability is nearly zero and quite insufficient to cope with ordinary variations of the wind. With the wings raised as a *V*, the situation is only a very little better. The only real solution for automatic transverse stability of an aeroplane rests in the flexibility of the wings. Such a solution is not attractive to designers, who wrongly fear to introduce complexity and reduce the solidity and stiffness of their craft. I know from experiment that this is a good solution, but I am not surprised to find it so little accepted. However, there are now two aeroplanes using flexible wings, and a more general use is certain. Flexible wings have a better sustaining power under ordinary conditions, and aeroplanes so equipped will be more manageable, less fatiguing and dangerous to operate, and can be flown in strong and irregular winds. This elasticity of the wings need be given only to the wing tips and after edges. Nothing will prevent any desired wing control, warping, rotation of wings, etc., whether there be one or several articulations or joints.

It has been attempted to replace flexible wings by a system called "la bride elastique," consisting in connecting the rigid wings by

springs to the platform carrying the motor and passengers. A consideration of the forces of inertia shows this system to be unsatisfactory.

Gyroscopic regulators have been proposed to act directly upon equilibrium. This is quite impossible. It is conceivable that a small and delicate gyroscope might be used as a special accessory, which, when actuated by the inclination of the aeroplane, would operate some other device to produce a righting moment. It should be noted, however, that the gyroscopic effect of the propeller has been known to disturb the equilibrium of both aeroplanes and dirigibles, and there is no remedy for it.

Automatic stability is also proposed by the use of a vane towed astern in such a manner as to operate the ailerons in case of a dive. The ailerons are normally controlled by the operator.

Such proposed methods are interesting and should be considered, but with elastic wings, such as were mentioned above and have actually been tried, an aeroplane can be made as easy to operate as a sail boat. And since there is no reason to make a sail boat operate automatically with compass or gyroscope, there seems to be no reason to speculate on how to make an aeroplane direct itself automatically.

BIPLANES AND MONOPLANES.

I have not yet mentioned the two classes of aeroplanes (biplanes and monoplanes) because theoretically there is little difference between them. The biplane type has been developed primarily because of its ease of construction. The braced girder with tension members of wire permits a strong light construction. For the same resisting surface and for the same weight, the sustaining surface is nearly doubled. However, practical tests have shown that the lifting power per square meter of wing area is greater in the monoplane. This is due probably to a decreased resistance and consequent higher speed. But for the same area it hardly seems that the resistance would be any greater if that area were in two parts. The discrepancy probably arises because the aeroplane does not move in a straight line at uniform speed in still air of uniform density.

The displacements of the center of pressure, due to irregularity in the speed of the motor, and variations in the force and direction of the wind, are incessant. Such displacements would exist even if the wind were a regular flow in parallel stream lines—which is never the case—and these displacements of the center of pressure

will not be the same on the two parts, if the surface be in two parts. Consequently, if one surface be in the best position for lifting power for least resistance, the other plane cannot be. The result is an augmentation of resistance, decreased speed, and less sustaining force. The girder construction of a biplane in itself offers considerable resistance, and the great rigidity of such construction forces the wings to act less efficiently than the more elastic wings of a monoplane. Exceptions prove this rule: Certain biplanes, with a rather elastic construction resulting from the use of only two struts, have shown very good sustaining power; while others with a rigid wing support with many struts, have been used to develop great speed on a reduced sustaining surface.

It is not always true that an aeroplane will carry double weight for a doubled area, and that consequently the biplane is the best type in all cases. Experience has shown that for a small weight, the monoplane is best. It is also the most convenient construction for a small machine. Above a certain weight, the truss construction becomes necessary, and the biplane becomes the logical design. What this limiting weight shall be, depends on many considerations. Aside from the strength of the materials of construction and the weight per horse-power of the motor, the design is influenced by the kind of service the aeroplane is expected to give. We could select the smallest motor to sustain any given surface, and the question of construction would determine whether a monoplane or biplane should be used. However, we may wish to realize a greater speed than that required by sustentation alone. Obviously, we must use a larger motor, disregarding any question of economy (weight lifted per horse-power) and will use the lightest construction possible. Since the variations in the wind which cause the increased resistance of the biplane are relatively of small importance at great speeds, this type of aeroplane would seem to have an advantage. Such reasoning holds only for moderate wings, but aeroplanes do not yet fly regularly in high winds. Large racing machines of biplane type are hence logical, even though the monoplane at present seems to hold most of the prizes.

I will show, at another time, that the ordinary variations in the wind have an absolute value which may be compared with the dimensions of an aeroplane. Such irregularities are relatively less important when the aeroplane surfaces are very large, and for a very great spread of wing, the monoplane construction must be abandoned because too heavy.

With an improved wing profile and increased speed, the limiting size of a monoplane is increased. At present, such a limit is about 1000 kilograms, but doubtless this will be doubled in future.

ORTHOPTÈRES.

In the history of aviation, we naturally find many attempts at mechanical flight by imitation of the flight of birds. Beating wings, at the present time, are looked upon with great intolerance by many writers who can see a future only for the aeroplane with screw propeller. They forget the debt we owe to the pioneers of heavier than air flight. Nevertheless, there are a few authorities who believe such an attitude unsound, and who are working to produce a practical "orthoptère"; a flying machine which will sustain itself and advance in air by means of beating wings.

We will now consider the advantages and disadvantages of a machine with beating wings, compared with an aeroplane with fixed planes driven by a screw propeller. First, however, I must point out a common error in the definition and conception of the "orthoptère." It is often said that the wings of a bird strike the air normally on a down stroke so that on the up stroke, by some strange miracle or sleight of hand, the resistance of the air is removed. The bird is supposed, perhaps, to fold his wings and then thrust them out for another down stroke, or to make an up stroke allowing the air to filter through his feathers as through a sieve. From such reasoning it follows that a surface, beating the air normally, has a greater effect than if its action were oblique. But even a superficial examination of a bird shows that it needs no such complicated maneuvering, and that the air never passes through his wing feathers. Also, a horizontal plane, forced to fall vertically, reaches the ground before the same plane falling in an oblique direction. Similarly, a screw propeller, if unable to turn, falls faster than one which is free to turn as it descends. These show the advantages of an oblique attack.

The fact is, that the wings of birds never strike the air normally, but always obliquely, with a large angle of incidence when rising off the ground and with a great expenditure of effort. In steady flight, the angle of incidence becomes but a few degrees, as is the case for all aeroplanes. In the analysis of the flight of birds, the motion of translation resulting from the movement of the wings has been neglected. The axis of reference has been taken on the

bird and moving along with it. But we can see that, when a wing is lowered, there is a forward motion of the whole body, so that the absolute motion of the wing with reference to an axis fixed in space, is in reality both forward and downward in an oblique direction. Just as in the question of equilibrium of aeroplanes, the stupidity of the theorists has led them to consider a static wing motion never found in nature, and their half truths have been incorporated by practical men into flying machines which refused to fly.

An " orthoptère " is a machine in which the wings beat vertically as in the case of a bird, but which strike the air obliquely as in the fixed wings of the aeroplane. The theory of the aeroplane is immediately applicable to the " orthoptère " with certain reservations brought out below.

Near the body of the bird, the beating of its wings has much less amplitude than at the tips, so that the inner part of the wing has little driving power and acts as a sustaining plane, exactly like an aeroplane. The wing tips furnish the motive power and at the same time contribute to sustentation. By reason of the great amplitude of its vibration, the wing tip must have a greater inclination than the rest of the wing. It is probable that in a bird the natural flexibility and elasticity of the wings produce, automatically, a deformation to give the proper variations of the angle of incidence to provide a propulsive component of force, and at the same time a sustaining component.

Even during the up stroke of a wing, the pressure comes on the lower side, and the upward movement is caused by the elasticity of the wing and the forward motion through the air. The great pectoral muscles—so much exaggerated in birds—furnish all the power for flight by their contraction. The role of the scapular or lifting muscles is wholly secondary, and the weak extensor or flexor muscles along the wing are not in use during full flight.

All the movements of the wings of birds, with their reactions upon the air during flight, were carefully studied by Marey thirty-five years ago, and after a careful analysis he proved the extreme simplicity of flight by beating wings.

A mechanical " orthoptère " should be very simple, consisting merely of a body, carrying a motor and passenger, and two flexible wings, having an alternating motion about a single longitudinal bearing. However, there is not yet a successful machine of this type. The first reason for this is the incorrect theory which has led

to fatal mistakes; and the second is the great prejudice among designers against movable jointed wings, which, they fear, will be weak, if they are flexible. Finally, there is no motor adapted to the control of the wings.

These objections may be overcome in future. The motion is a simple reciprocation in one plane; the construction is not difficult, and with a single articulation should not be heavy; flexibility is no longer a problem, for aeroplanes are now in use with flexible wings which are both light and strong. The question of a motor presents greater difficulty. The trouble comes from the slow speed of the wings, 20 or 30 strokes a minutes for a machine of 200 or 500 kilograms. A light motor must run at high speed to develop its power with a low torque. There must then be some reducing gear, having considerable weight. Yet some aeroplanes have found an advantage in having a reducing gear, and the extra weight may be balanced by a gain in efficiency of the machine as a whole.

Another objection is made to the "orthoptère" on the ground that a reciprocation is inferior to a continuous motion. This is largely a matter of opinion. Only in turbines and electric motors can we get a continuous rotation without starting from a reciprocating motion. In such a medium as air, a slow reciprocating motion may be much more advantageous than the continuous rotative motion of a high-speed screw propeller. Present-day aeroplanes, running their propellers at 1000 to 1500 revolutions per minute, give a tip speed of over 200 meters per second. This figure will no doubt be exceeded by the high-speed aeroplanes predicted for the future. A high speed is, of course, favorable to sustentation and to the action of a propeller blade, but there is obviously a limit. This limit is already passed in the case of screw propellers, for experiments show a gain in efficiency with larger and slower propellers. This is not a general rule, and it will be mentioned later in the discussion of propellers. In an "orthoptère," the speed of wing tip is about one-third the speed of blade tip in an aeroplane running at the same velocity. For very high speed, then, the "orthoptère" would have an advantage.

The principal argument in favor of the "orthoptère" is its compactness. The wing, being active, has greater sustaining effect than when acting passively, as in an aeroplane. This makes the former especially adapted for small machines for short trips with one or two passengers. Such small machines are the easiest to

build, and it is possible that some day there will be "orthoptères." In addition this type is easily stored, and has special facility for landing or rising from restricted spaces. It is possible that such machines may become very common, and for that reason I have included this discussion. The special advantages must not be exaggerated, and it must not be assumed that an "orthoptère" can rise without a space before it. It seems natural to think that with flapping wings, a machine could rise vertically from the ground, but the impossibility of such a feat is pointed out above.

I believe there has been only one successful "orthoptère." That one was a model made by Tissandier thirty years ago, but at present such flight, though interesting, is hardly in an experimental stage.

It is interesting to note that small birds fly with flapping wings, while heavy birds fly in this manner very little, showing a marked preference for soaring ("vol plane"). There is no bird heavier than 10 kilograms that can fly with flapping wings for any considerable time. Of course, with tireless mechanical motors more powerful than the natural ones, the limit on weight will be much greater. This observation serves to confirm my opinion that the aero-motorcycle of the future will fly with flapping wings.

HELICOPTERS.

A class of machines having more supporters than the preceding is the helicopter in which both the propulsive and sustaining forces are given by screw propellers. The system has the following advantages: Direct use of rotational movement, ability to rise or land in a vertical line, ability to hover over any given point. The machine consists of a car with motor and passengers, having one or more propellers with vertical axes to give sustentation, and one or more propellers with horizontal axes for propulsion. This combination of propellers may be replaced by a group in an intermediate plane which will give the same components.

All this demands great weight and complication of machinery, and though a possible solution, is not a good one, for the screws with vertical axes have only a small sustaining power, even under favorable conditions. There is an absolute limit placed upon them by the fact that the weight of a propeller will increase with the cube of a diameter, if it exerts no force, but at a greater rate when a reaction is met. On the other hand, the reaction or thrust of the propeller increases much more slowly than the cube.

Toy helicopters, launched by springs, whose power is out of all proportion to the weight lifted, are most successful; but full-sized machines have recently given most discouraging results. They were with great difficulty raised a small distance, and sustained only a little while. Calculation from the observed efficiency of the screws seemed to prove that flight was possible. But the fact was overlooked that the lifting screws were turning near the ground, so that the discharged streams of air could not easily escape. It is reasonable to suspect that the thrust, under such conditions, is exaggerated, and there is small hope of ever seeing a helicopter stationary in the air. In such a case, the great screws, turning at high speed, would produce a downward current in the air, in which it would be very difficult to sustain a body of any size.

Another practical difficulty rests in the fact that, whether with one set of screws or two sets at right angles, when the machine moves ahead the screws work on oblique streams of air. The result is an uneven action and shock on a blade at every revolution. The efficiency is much reduced, and a heavier blade construction is required.

Therefore, in spite of the apparent simplicity of the helicopter, I believe it can never be successfully built. It is interesting to show that the flight of insects is similar to the helicopters, and it is easy to propose a large machine to imitate this natural flight. But the theory of the screw propeller shows that such an application is valuable only with a very small weight. Observation and theory agree in condemning the helicopter of any weight above a few kilograms, and at the same time, recommend it for little flying toys.

SCREW PROPELLERS FOR AEROPLANES.

After helicopters, it is natural to take up the subject of screw propellers in general. Surprising as it may seem, the theory of the propeller is not well developed in spite of the learned volumes written about it. The design of practical propellers to meet definite requirements is entirely empirical. This is the result of the barrenness of the methods of pure science. The mathematicians have a tendency to consider the entire arsenal of mathematical processes as a science complete in its abstraction, and with little reference to natural phenomena, while, at the same time, physicists often tend to avoid mathematical analysis. The result is that this splendid instrument, mathematics, though only a tool, finds few hands

capable of making effective and practical use of it. In order to apply the mathematical treatment, certain assumptions are first made, restricting the phenomena to a special case more or less impossible. The results are then translated into formulas, which, once established, permit a full mathematical development—integration, exterpolation, and all the flights of a spirit embarked in the realms of serene abstraction. In the meantime, the original assumptions have been forgotten, or ignored, and the precise conclusions, reached with such brilliant effort, lead to bitter disappointment when applied to real conditions which have never been analyzed.

In the matter of the propeller, it is surprising to note the restrictions made to facilitate the use of mathematics. Formulas and curves so developed have no practical application. The experimental method has, therefore, been turned to, but in order that our experiments may be fruitful, there should be a fair working theory of the propeller to serve as guide. Such theory, even if very approximate, will be corrected and further developed by the experimental work. Curves of thrust and efficiency have been made for many propellers, but these are isolated examples not connected by any law. A rigid analysis of the phenomenon should have been made first, for it is probably the resultant of many independent phenomena superposed. The problem becomes, therefore, one with many independent variables, and can hardly be expressed in a single general formula. The common theory cannot bring out the effect of such variables as the angle of slip, profile of the blade, speed already acquired by the aeroplane, etc. The problem is similar to that of the wing surfaces, and the final result will only be reached by the experimental method. But it will not be necessary, when one factor has been determined, to apply to it all the flights of mathematics. What we need is simply a penetrating analysis, certainly difficult, but demanding only logical reasoning to separate out as many as possible of the elements of this complex action. We hope that soon our aerodynamic laboratories will give us a practical theory of the propeller.

In the meantime, we must not make the mistake of considering the propeller apart from the aeroplane on which it will be used. It means nothing to say that a certain propeller gives a certain thrust, and we must not base our prediction of its performance on trials made with the propeller alone, thrusting against a fixed point. The

present theory, though incomplete, is an aid to understanding the action of the propeller, but experimental work must proceed with full-sized propellers in flight, or under identical service conditions.

The most striking feature of aeroplane propellers is their great speed, 20 to 30 revolutions per second, giving a tip speed of 150 to 200 meters per second. Such excessive speed is demanded by motor design, and operates to reduce the number of blades and the pitch, while friction is increased as well as blades stressed. It would help designers if the theory could give the limit on speed, or could prescribe the conditions to meet any given speed. It has seemed of advantage to reduce speed by some reduction device on dirigibles, and probably most aeroplanes except the smaller racing machines will find an advantage in such reduction of propeller speed. Some of the larger aeroplanes in which a reduction is made have proved very satisfactory. The gain comes from a larger number of blades, larger diameter, or a larger number of propellers driving the machine, and in general an increased propulsive area. It is obvious that, for good efficiency, there must be a lower limit on this area.

A most important effect of the high-speed propellers is the gyroscopic action, which is considerable in spite of light construction. This effect may be beneficial in contributing to longitudinal and lateral equilibrium of an aeroplane or dirigible, but at the same time, it is blamed for serious accidents. The propeller tends to remain in its plane of rotation and to resist the action of the rudder. On a sudden turn, the shaft and blades are abnormally stressed. Rupture comes at a time when the equilibrium is not steady, and a fall is probable. There have already been several catastrophes due to propeller failure.

Another cause of fractured shafting is claimed to be vibration. The shaft and propeller will vibrate with a natural period, depending on the dimensions and the method of supporting. If this period synchronizes with the impulses of the motor, the resonance established will increase the amplitude of vibration to the breaking point.

Also, in flight, the thrust is not in line with the axis of the shaft. The latter is usually inclined with respect to the wings by an angle equal to the angle of incidence of the air on the wings in steady flight. The effect is that the propeller has a vertical inclination to the stream of air in which it works, and the uneven action of the blades will produce a shock on each blade at every revolution. This

point was brought out in discussing helicopters. Ordinarily the angle of inclination is small and the effect can be neglected. However, the vibration may be added to that described above to produce disagreeable oscillation.

Such points must be considered with reference to the advantage of light construction and a low factor of safety. Vibration must be reduced, and sharp changes of direction and altitude avoided. The acrobatic feats of a certain class of aviators should be forbidden unless their machines are especially designed for that purpose.

For security it would appear of advantage to have more than one propeller, but if disposed laterally, the stopping of one might destroy equilibrium. It is possible to avoid this difficulty, and machines with two screws have been made, but driven from a single motor.

Two motors would afford security against the failure of motive power. Such an installation is quite possible, and it could be arranged to drive two propellers by either motor or by both. There would then be two independent propulsive units, one in the rear of the other.

JET PROPULSION.

It has been predicted that, in the not far distant future, velocities as high as 300 kilometers per hour will be attained. This is, of course, Utopian, but were such speed to be realized, the screw propeller would be inadequate. A tip speed of 500 meters per second would be required, and no known method of construction could make a blade of reasonable weight sufficiently strong.

A fluid passing through an orifice from a tank, where the pressure is high, to the atmosphere, may attain a velocity as high as 1000 meters per second. If the difference of pressure could be maintained, the reaction of the jet might be utilized. It is proposed to carry some machine to generate a fluid at high pressure and to discharge it downward and to the rear to create forces of sustentation and propulsion. Such a discharge should be by puffs at short intervals, so that the outside air would not be set in motion creating a current opposing the aeroplane.

It is not difficult to find serious objections to such a scheme. Even at the extreme speeds spoken of so lightly, the mechanical efficiency of the apparatus would be very low, and for present-day speeds, would be practically zero.

Such motive power would make rising and landing a most violent operation, requiring buffer springs and an extremely rigid and heavy construction.

It is hardly probable that a machine will ever fly with the propulsion of a jet.

AEROPLANE MOTORS.

The light motor made aviation possible, and the effort is still being made further to lighten it in order to increase the capacity for carrying load, and, consequently, the radius of action. Nevertheless, extreme lightness must not be attained at the expense of reliability and endurance. A weight per horsepower of 3, 5, or even 10 kilograms is permissible at present, and with the probable increased efficiency to be expected, the present type of motor should be very satisfactory.

Aeroplane motors work under no special conditions, and can apply any improvements made on automobile motors, or explosion motors in general. There have been doubts as to the performance of aeroplane motors in the rarified air of high altitudes, though automobiles find little difficulty in climbing mountain passes of great height about sea level. A proper adjustment of the carburetor and the ignition should provide for any altitude changes. A considerable loss in power is not a serious drawback, for aeroplanes in practice are always greatly overpowered in order to meet strong air currents or to climb quickly to 1000 or 2000 meters altitude. And if the more rarified air at a great height gives less sustaining effect, the resistance is also less and for a given power the speed should be much increased.

Cooling is the most serious problem in motor design, and increases in difficulty with increase in power. A decrease in pounds per horse-power is prevented by this difficulty of getting adequate cooling without the use of auxiliary apparatus.

However, the last word in motors has not been heard yet, and perhaps, very soon, we shall have an internal combustion turbine, which will be lighter and less subject to vibration than the piston motor.

The future of aviation is much concerned by the possibility of installing a propulsive system of several motors and propellers in such a manner that failure of one motor will not affect the others. In such a case, there would be reasonable security against the risk of a forced descent, a risk least attractive for over water flying.

The solution is fairly simple, but demands some sort of transmission device The claim for reduced propeller speed also required such transmission as shown above, and allows high-speed motors of reduced weight.

Variable speed is hardly of advantage in an aeroplane motor, except for a few moments before landing. Variable speed can only be given at the expense of reliability and endurance and considerable complication must be introduced. This complication can well be avoided in an aeroplane motor, which should have in practice a single operating condition, corresponding to the most favorable speed and load of the aeroplane.

LAUNCHING—LANDING.

Except for a helicopter, speed is necessary before a machine can sustain itself in the air. Consequently, before taking flight a velocity must be imparted by some launching maneuver.

Wheels on the aeroplane are an extra weight of no advantage in flight, but nevertheless they render the machine entirely independent of a fixed launching or landing place. An aeroplane can then rise from any place where a clear field ahead can be found, and the equipment need not be very heavy for a machine of from 500 to 1000 kilograms.

Launching by means of a spring, catapult or similar device has the great disadvantage of making the machine dependent upon a fixed installation, to which it must return before making another flight. The machine itself could, of course, be made lighter by doing away with a carriage. The disadvantage of fixed stations of arrival and departure would have less weight in special cases. For instance, the great passenger aeroplanes of the future will require such stations, just as we now need railroad stations and wharves. For small aeroplanes to be carried aboard ship, a special launching or landing arrangement would not be a serious inconvenience.

Another method is to allow the aeroplane to slide down inclined rails until a sufficient speed is attained. In a similar manner birds often take flight from an elevated position.

The speed necessary in launching is obviously with reference to the air, and if at the start, the wind has a velocity with reference to the aeroplane, the velocity to be acquired may be less than for rising in still air. Consequently, launching against the wind requires less speed and less space, and a similar advantage is afforded

in landing. Launching will be obviously easier if the aeroplane has a great excess of power, but in order to benefit by this excess there must be movable horizontal surfaces, such as horizontal rudders, large ailerons, or the wings themselves movable. At the start, the angle of incidence is increased to increase the sustaining force, and when well under way, the angle is decreased to increase speed and prevent the aeroplane rising higher.

Most careful consideration must be given to the air currents produced by any platform for launching or landing. The question comes up at once when aeroplanes are to be launched from or to land upon a ship's deck. It will generally be possible to facilitate such maneuvers by taking advantage of conditions.

Landing appears simpler than rising, for it is always easier to check a velocity than to impart it. But the operation is rather ticklish, and requires shock absorbing devices. To alight with precision upon a small platform, the wings should be movable, or special braking surfaces provided on the aeroplane.

AVIATION IN THE NAVY.

Aeroplanes are universally considered to have great value as instruments of sport, and it is admitted that in special cases they might be of real service to an army in the field. But with a few exceptions, it is denied that the navy has or ever will have any use for them. It seems a shocking blunder to spend several hundred thousand francs (in a budget of 400 million) on air craft that might well be spent on battleships. The rôle that is claimed for them is also that of wireless telegraphy, infinitely more sure and rapid.

Therefore, before commencing an argument that my brother officers may follow with considerable distrust, I wish to make my position plain. I agree that the navy should be made up of ships; as many ships as possible for the money available. But I also believe that these ships should be of the type to assure victory in battle—battleships—"capital ships." Cruisers, scouts, destroyers, torpedo-boats, and submarines are all auxiliary to the battle fleet. Though such auxiliaries are necessary, their importance must not be exaggerated to the point of spending on them half, or more than half, of our appropriation, as has recently been done. The navy has suffered from a craze for flotillas of useless and costly auxiliaries of every type, whose only reason for existence is a supposed

A short time ago the true state of affairs was realized and the construction of torpedo-boats and cruisers was discontinued. At the same time, it was not forgotten that a navy cannot be composed of battleships alone. Though no torpedo-boats are built, there are many submarines, and in place of cruisers we now depend on powerful armored cruisers to make reconnaissance, as well as to take a place in the line of battle. And there also has been developed scouting tactics for the battleships themselves. Great and costly armored cruisers have a short life, and scouts are proposed. Destroyers are made larger and larger with the hope of using them as ocean scouts.

It is absolutely necessary for an admiral, as for a general, to be well informed regarding his enemy, before he can act with confidence and precision. Wireless telegraphy has rendered the *transmission* of intelligence prompt, sure and economical, but, in addition, there must always be agents to *collect* information, as fully as possible, at the greatest distance possible, and as often as possible. With the great mobility of modern fleets, the setting of the chess board of strategy and tactics is constantly changing.

Aeroplanes are especially adapted for this important service by their ability to mount rapidly to 1000 meters altitude, to maintain a speed of 50 or 60 knots, and to observe without danger to themselves. They can be fitted with wireless telegraph apparatus of small weight, and due to their cheapness, we can have great numbers of them at an expenditure of but one or two per cent of the total appropriation, instead of the usual 30 to 50 per cent.

Considerations of economy, first urged against providing aeroplanes, will end by forcing aeroplanes upon the navy and will hasten their development and application to naval uses.

But aeroplanes need not only be scouts. They are especially valuable in detecting a submerged submarine, due to the fact that, from a great height, a man can see far beneath the surface of the water. The recent progress in the effectiveness of the submarine has created a most dangerous risk for a fleet, even when at sea, against which no means of defence has been devised. Although aeroplanes would not be an absolute security against submarine attack, they are nevertheless the best defence available.

Also, the aeroplane could be employed to find out the position of submerged mines, or floating mines, and to guide a squadron through a clear channel between such dangers.

It is probable that the aeroplane could be of great service for fire control at extreme ranges in observing the fall of shell.

But aside from the function of an observer, cannot the aeroplane serve as a weapon of direct offence? It could carry powerful explosive enclosed in a resisting envelope like a shell for a gun. An aeroplane, detailed to watch for submarines, would carry several such bombs, which could be dropped near or upon a detached submarine. The explosion could be arranged to occur at a given depth, or against the side of the submarine, and the injury to the submarine would sink it, or force it to come to the surface to surrender.

Similarly, bombs dropped into a mine field would doubtless serve effectively as counter mines and clear a channel for a squadron.

Fire bombs for lighting up a field of battle are very heavy and expensive when shot from guns, but if to be carried up in an aeroplane, they could be made very light. Their effectiveness would also be enormously increased because such bombs could be dropped from an aeroplane over the place to be lighted, attached to a small parachute, so that the light would last a long time. In this way, aeroplanes could co-operate with a torpedo attack upon a squadron, while at the same time the defenders could use the same means as a defence against the torpedo-boats in conjunction with their defending destroyers.

The number of ways an aeroplane can be of service seems unlimited in such special cases as the siege or defence of a fortress, combined operations of ships and troops, landing a force, etc.

I shall not attempt to look far ahead to the day when great aeroplanes will transport 20 or 50 men and several tons of armament, for by that time the art of war by land and sea will be so revolutionized that our present principles may not apply, and deductions based thereon will be false.

However, let us return to the actual and immediate possibility of aviation in the navy.

THE NAVAL AEROPLANE.

The characteristics of the naval aeroplane are determined by the function it is designed to exercise.

If the rôle of an aeroplane is confined to that of watching the entrance to a harbor or roadstead, it may be a very small machine. Only one observer beside the pilot need be carried, and the supply of oil and gasolene should be enough for a maximum duration of flight of two hours. Only a small weight of explosive would be

taken aloft. Floats must be provided of volume sufficient to prevent sinking in case the aeroplane were forced by motor trouble to land on the water. In all other respects, the aeroplane would be of the ordinary type.

If the aeroplane of great size and endurance is soon developed, such a type could be used to serve a squadron within a hundred miles of the coast. A great radius of action would be required, and launching and landing would always be on shore. However, to prevent loss in case of a forced descent at sea, floats would be provided as in the type above, and arrangements made so that the aeroplane could be hoisted aboard ship without damage and brought ashore again.

But it is evidently of great advantage to have the aeroplane stationed on a ship from which it can be launched, and upon which it can land. For such a purpose a garage vessel has been proposed to accompany the fleet and shelter a half dozen aerial scouts. But in order to be of any real value such a ship must be a great vessel with enormous deck space and with a speed equal to that of the fleet. The probable cost of 15,000,000 francs would hardly be justified, even if the number of cruisers were reduced. Besides, such expense is not necessary.

Modern battleships of the largest size can easily provide space for the launching and landing of aeroplanes without interference with essential features of design nor great expense. In addition an aeroplane can easily be taken apart and stowed below if it be desired to keep it aboard during action—this is hardly probable, however. At any rate, the problem of rising from a ship's deck and landing upon it is now being studied by able minds, and we can expect a practical solution at any time.

The naval aeroplane looked on with most favor by all [except sailors] is the hydro-aeroplane fitted to rest on the surface of the water and take flight directly from it. Such machines are useful only in absolutely still water, and with even a very moderate sea trouble would be experienced. To float on the water is no great advantage, except perhaps for a great aeroplane acting independently of a ship and attempting to make a protracted cruise. In such a case, the aeroplane might desire to rest on the water at intervals. However, such a utilization of an aeroplane will not come in the near future nor for the aeroplanes of moderate size.

It is now possible to define the qualities of an aeroplane to suit general considerations. When a demand is made for a definite

service, I have no doubt a number of types will be offered, all more or less fulfilling the conditions. A careful selection after trials will then establish their relative merit. But the designers need some sort of guide, and it is expected of the navy to write its own specifications. In the present status of the aeroplane, I believe the question should be brought up in this manner:

A competition to be held by the Navy Department for a naval aeroplane.

1. A naval aeroplane shall be defined to include any type of aeroplane which by means of special floats, water-tight body, or even thick wings serving as floats, has the ability to float on a moderate sea (wave height one meter), in a moderate breeze (10 to 12 meters), for several hours without injury to passengers or machinery. The motor to be of such construction that, after several hours in the above position, it can be overhauled and put in operation in a few minutes

It seems that the monoplane would be preferred, but any type might enter the competition, provided it met the conditions specified.

2. Any machine presented to be so constructed that it can readily be hoisted from the water and landed on a ship's deck by the ship's crane.

Such an arrangement might be, for example, a strong ring secured to the body of the aeroplane in such a manner that the whole machine can be suspended from it without danger to passengers or to the machine itself. It will not be required that an aeroplane take flight from the water. If such a machine be submitted, it must meet all the other conditions of the competition.

3. A naval aeroplane must be able to take flight from or land upon the shore under ordinary conditions.

4. Speed is not specified, but other conditions equal, speed will be considered an advantage.

5. Details of construction are not satisfied, but preference will be given to machines that are the simplest to handle and to stow aboard ship. It is considered an advantage if a machine separates easily into parts convenient for stowage or transport.

6. The naval aeroplane should have great stability and good maneuvering qualities.

7. With reference to power and endurance two classes will be recognized:

a. An aeroplane *scout* shall carry two passengers, a pilot and an observer for 3 hours, with an extra weight of 50 kilograms, giving a total weight carried of 200 kilograms, exclusive of necessary oil and gasolene for the motor. With such loading, the aeroplane must attain an altitude of 1000 meters in 20 minutes.

b. An aeroplane *cruiser* shall carry three passengers, a pilot, a mechanic and an observer, for at least five hours, with an extra load of 100 kilograms, giving a total weight carried of 325 kilograms, exclusive of necessary oil

and gasolene for the motor. With such loading, the aeroplane must attain an altitude of 1000 meters in 20 minutes. In flight, the observer, pilot and mechanic may alternate in driving the machine. Employment of two motors, propeller groups which function separately or together, is considered an advantage, provided one motor alone has power enough to sustain the aeroplane, and that there is no dangerous shift of equilibrium if one motor stops suddenly.

8. The Navy Department will furnish a plan of the facilities for launching from a ship and landing arrangements in order that designers may adopt their aeroplanes to service conditions. Designers may suggest any changes they see fit, but are in no way to be considered responsible for the operation of such appliances provided by the department, as they are for the sole use of the department pilots.

USE OF DIRIGIBLES AT SEA.

The dirigible balloon is thought by many to be the type best suited for naval use.

The balloon has a few advantages and many disadvantages. It is considered an advantage to be able to hover over a fixed point on the ground. This is of course possible for a balloon only when the velocity of the wind is less than the rated speed of the balloon. The balloon is in less danger from failure of motive power than an aeroplane, but over water this advantage has less weight than ordinarily.

The disadvantages of the dirigible are many and serious. The first is the great expense, including first cost, housing, equipment, and landing facilities. The life is short and precarious, even when frequently overhauled. The low speed (lower than that of the aeroplane) is a disadvantage and prevents flight in winds that an aeroplane can successfully cope with. The dirigible maneuvers very badly both on the ground and in the air, and can reach an elevated position only very slowly. By reason of their immense size, they present a most vulnerable target to hostile ships or even aeroplanes. They are also greatly affected by variations in temperature, humidity, solar radiation—elements having almost no effect on the aeroplane. A dirigible cannot in any way be carried by a ship at sea, so that their use is prohibited at any distance from shore.

I believe that the dirigible balloon will only be used by the navy for observations in the immediate vicinity of a port.

Experiments should be undertaken to determine the possibility of detecting submarine mines from an aeroplane. But in the meantime such work can better be done with a dirigible, moving slowly over the mine field at a sufficient height to give a good view below

the surface of the water, and still low enough to make use of a guide rope if necessary. Such observations would have to be made in a place covered by the guns of the shore batteries, and at a time chosen when the wind is not high. An auto-balloon of moderate size—1500 to 2500 cubic meters—would be the best type to use.

It is, therefore, reasonable to expect that at every naval base there will be one or more hangars with two or three small dirigibles each. But it would be false economy to attempt to enlarge the sphere of usefulness of such dirigibles by increasing their displacement. Scouting must be left to the aeroplanes.

CONCLUSION.

I stated above that the object of this paper is to clear away a certain amount of fog, and to create in the navy a favorable attitude toward naval aeronautics. For this reason I have attempted to show the different aspects of the case, rather than to solve the many problems that are presented. I have omitted all intricate technical discussion, and the use of figures and formulæ. The flight of birds is only mentioned, and no analysis is made of soaring without power, at present most useful and interesting. And I hope that what has been written or the ideas suggested by reading this paper, will destroy much hostility toward aviation, and that the tests which the Navy Department is about to commence will be watched with interest if not with sympathy. This is the only ambition I have for this modest work.

In the development of any new science or industry, it is necessary to wait for the progress of private enterprise. But in this case, progress is of such vital importance to the state, for the army, navy, postal service, etc., that the Aerodynamic Institute should be generously subsidized. Funds should be granted to conduct a long series of methodical tests on full-sized machines, and pilots and observers should be supplied by attaching to the institute officers and engineers who desire to specialize in aeronautics. It will not be a question of allowing inventors to develop their ideas at the expense of the state, but to create something similar to the experimental model basins used by all navies. These basins have given out such precise and valuable experimental data, that sometimes the saving in power for a single battleship is worth as much as the first cost of the basin itself.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SHORE PATROL DUTY IN THE NAVY.

By MIDSHIPMAN S. R. CANINE, U. S. Navy.

Having done patrol duty a number of times, and for as much as two weeks at a time, I feel justified in expressing my views regarding this important duty.

My views are those of one who has always been a junior patrol officer, and of one who has always been in close touch with the men on liberty and with the patrol. I do not wish to criticise, but to state my ideas on patrol duty in general and possibly give a few helpful hints to the younger officers who have never had this duty. My experience with this duty has been in foreign places entirely, and is as follows: Two weeks continuous duty each in Shanghai, Panama, Bahia Blanca, Argentine Republic, one week in Manila, and day's duty in Honolulu, and other places.

When ordered on patrol duty for the first time, one usually asks the question "What am I to do and what system is to be used in handling the patrol?" There is no fixed rule. It all depends upon the city to be patrolled and the number of men given you for duty. Each city is a problem to be worked by the officers on duty.

Arrangements are made with the city officials for sending liberty parties and a patrol ashore and a place is assigned by them as headquarters for the patrol. This varies from a room in some old deserted building to quarters in the fire or police station. The officers can either take quarters with the men or go to some nearby hotel. It is necessary to keep in close touch with the patrol headquarters.

The patrol should be carefully instructed concerning the fleet get located in the assigned quarters and for the officers to get the patrol posted.

It is well for the patrol officers to be on intimate terms with the chief of police and to ask his coöperation. Explain to him that you have the patrol there to assist his force and that in minor cases where a bluejacket is arrested it is best that the man be

turned over to the ship's patrol; that the man will surely be punished on board ship. The chief of police, or any of the police force, can best tell you where trouble is most likely to brew and the limits of these places. The patrol can then be divided into watches according to the number of places to be patrolled, and the first watch posted. On posting the first patrol it is well to take the whole patrol force along that they may be informed as to the places they are to patrol and that they may know the way to their beats. Good reliable men may be allowed to relieve their men without being posted by an officer. If possible, detail the patrol in pairs. They are much more efficient this way. One man is naturally timid about exerting his authority where there is trouble, while if he knows that he has a good man to help him, he will tackle any trouble. Then again, two men will be needed if any are needed. Liberty men from one ship will sometimes band together and impose upon a weak patrol if he be not from their ship.

In some places it will not be necessary to keep the patrol on duty all night. At least it may be diminished and some places will not need patrolling at all. Trouble usually is more apt to occur between the hours of nine and eleven p. m. After this hour the bluejackets begin to retire or return to their ships. I have found that trouble often occurs in the "red light district" in the early morning when the men are leaving to go home. After midnight one or two men can patrol what several men were required to patrol earlier in the night. Many times requests will be made by managers of some theatres or moving picture shows or similar concerns for a patrol and I have found that the patrol has done much good at these places. A disorderly bluejacket in a public place of this kind does much toward lowering our navy in the eyes of the foreigner. A patrol at these places who does his duty creates the best possible impression.

The patrol off watch should be kept at headquarters, for calls frequently come in from places where there is no patrol. Where the patrol is permanent, and there are enough men to allow it, I believe that the men should be given liberty.

Personally I believe in a permanent patrol of picked men. Where the patrol is shifted from day to day, the efficiency of the patrol is greatly reduced. The men do not get on to the swing of things and most of the time is taken up in instructing the patrol, relieving them and posting them. Men who have the duty for all

time learn the system thoroughly and do their work efficiently. They learn the haunts of the men where trouble is most likely to occur and the times that certain places should be watched. They are also capable of relieving each other and of being sent to unpatrolled places without a guide. Where the men are shifted from day to day, it is quite impossible always to have thoroughly reliable men. The best men possible should be detailed on this duty. Sometimes patrol duty is looked upon as something unimportant and men are sent on this duty that are worse than useless. This creates a bad impression. They should be men that have as much of a military bearing as possible and men that are strictly duty men. It is a disgrace to our men to have a patrol on duty that will stop to joke with "the girls," and be otherwise inattentive to duty. An efficient patrol creates in foreign places the highest respect for our navy and our country.

Often the number of patrol at your disposal is insufficient. The only thing to do is to put them in the most dangerous places. In a large place no attempt can be made, or should be made to patrol the entire city. The most respectable places do not need patrolling. It is only the tough places and the cheap saloons.

The patrol should be given all reasonable attention while it is ashore. A means of returning men to their ships should be arranged and carried out. When the ship or ships are anchored far from a city and large parties of men are sent ashore to attend some function, special care should be taken to see that the men are provided a means of returning to their ships that night and not left in the city moneyless as they sometimes have been.

A discouraging thing to the patrol officer is the failure to keep in touch with the ships and to have them coöperate with him. Each ship should send to the patrol officer each day the number of men sent ashore, the time that liberty expires, and the names of the absentees. The uniform should be given the patrol officer, he should have a boat schedule from each ship, and each ship should keep him informed of all changes.

Absentees should be searched for and each patrol should know the names of the absentees. Men breaking liberty often live ashore at some hotel or low place or in rooms attached to some saloon where the manager is "a friend of the boys." Of course they go to other places, but they frequent these mostly as they receive a welcome there and the living is cheap.

The patrol should be carefully instructed concerning the fleet regulations regarding patrol duty and, if any member be found breaking them, he should be arrested, and returned to his ship.

A patrol should be detailed from the ship to go on all liberty boats. He not only keeps order on the boat, but men being returned to their ships can be placed under his charge and thus keep the shore patrol intact.

One great trouble in foreign places is with the hack driver or the 'rickshaw man. They often try to overcharge the men, especially if they are not perfectly sober, and if the men (never but a very few) are mean about paying the proper fees. Do not unhold the driver without good cause, for, knowing that he can come to you with his troubles, he will bother you continually, telling lies about not being paid. The patrol officer is charged with the conduct of the men ashore and he should take care to see that they are given fair treatment in all places. When a bluejacket is arrested by the local police he should inquire into the case and where proper try to have the man sent back to the ship where his punishment will serve as a lesson to the men.

The value of our patrol is greater than many people will consider. The mere presence of our patrol will prevent trouble where the local police would or could not have prevented it. A bluejacket knows that if he is arrested by a patrol that he is sure to receive punishment and that it will be put on his record, while, if he is arrested by the local police, he may have to pay only a small fine or be confined for a short time. They also know that they must behave properly on the streets or be sent back to their ships. A bluejacket dreads losing his liberty in a foreign port and this serves to keep him good when there is a patrol ashore.

Patrol duty is instructive to the officers in that they are continually meeting people of all classes and nationalities and they are frequently called upon to handle cases that require tact and diplomacy.

The beach patrol should always be separate from the shore patrol and this patrol can be shifted as often as desirable and without harm.

There are many little points connected with patrol duty that might be given. They are easily learned, however, and it is not necessary to state them. The main thing is a permanent patrol of both officers and men, and both must be of the best.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

DIESEL ENGINES FOR NAVAL PURPOSES.

By LIEUTENANT A. K. ATKINS, U. S. Navy.

The application of the internal combustion engine to marine use has been an attractive problem from the time when the engine became a successful machine. In the following notes an endeavor has been made to set forth accomplished, dependable facts, and to preclude fanciful ideas or theories. The comparison drawn is based upon an actual experience with steam machinery, realizing that the reciprocating steam engine is very near the top of its curve as far as efficiency and reliability is concerned. Without much doubt the internal combustion engine, as exemplified by the Diesel type, is the power that will be reckoned with in our service at no far distant date, and we are on the verge of an economic development in the use of fuels and machinery that is very little realized. In this country we are so extravagant as a nation, and our present incentive for economy of power is so slight, that we are years behind Europe in the development and use of means for the conservation of our natural resources. On the continent of Europe they have been gaining invaluable experience with the Diesel engine for the past eighteen years, and have placed it upon such a utilitarian basis that we will soon be forced from our lethargy to a lively interest in the matter and will find ourselves confronted by the steep hill of experience to be surmounted before we can apply the engine to our own problems. It may be that the navy will be required to force progress by its particular demands for increased radius of its heavy ships, increased power on a limited tonnage, and other features of a military nature, to keep pace with foreign progress.

For the internal combustion engine to replace the steam engine for naval purposes, taking the two types solely as machinery plants in themselves and disregarding the advantages or disadvantages that will naturally follow in the wake of either, it must, in doing

the same work: (1) be more economical in space and weight per effective horse power: (2) be more economical in fuel consumption (for naval use this relates to increased radius on the same weight of fuel, rather than on the *cost* of the fuel): (3) develop its horse power on relatively low speeds of revolution so as to obtain high propeller efficiency: (4) be reliable in operation and as capable of minute speed regulation as the prime mover of the steam plant.

The gas-producer plant, in its present form, fails in economy of space and weight, in reliability, and at low speeds is not markedly economical over our present steam installations; its stand-by losses are also equally as great. From this discussion, then, on the basis of the foregoing indictments, the gas-producer will be dismissed.

The first note we have of the Diesel engine is in Dr. Rudolph Diesel's paper on the subject in 1892, and his idea at that time was to develop an engine to operate on the Carnot cycle, and an engine to burn coal in the working cylinder. Practical engineers recognized at once that it would not be possible to attain that which Dr. Diesel sought, and for a commerical engine it would be necessary to carry away some of the heat of combustion; also, that the unburned residue of the solid fuel could not be removed from the cylinder. Accordingly the cylinders were water-jacketed, pistons cooled, and heavy oil adopted as the fuel. This condition of things will, no doubt, remain unchanged.

The Diesel engine is essentially a slow combustion or a constant pressure motor; that is, heat is produced during an appreciable time while doing work, the volume of the working medium changing. The ignition and combustion of the fuel are produced by the compression of air to a high degree in the working cylinder. Pure air is drawn into the cylinder and compressed to about seven or eight per cent of the cylinder volume, or to about 500 pounds to the square inch; the air in this state is incandescent and at an approximate temperature of 1000 degrees Fahrenheit. This, the first process of the cycle, Dr. Diesel expected to carry out adiabatically, with an insulated cylinder, up to about 3000 pounds per square inch. The next process is the admission of the fuel, which is ignited by the compression temperature. The fuel is admitted at about the top center, and admission continues until the stroke has progressed ten or twelve per cent. Heat is produced doing work

during this admission as the volume is changing, and the pressure in the cylinder remains practically constant. This process in the original idea was to be carried out isothermally, and it is this production of heat during an appreciable time at constant pressure that gives the name " constant pressure " cycle in contradistinction to the " constant volume " cycle upon which gasoline or explosion motors work; and where the heat is produced instantaneously by the explosion of the fuel mixture by an ignition spark. The third heat process of the Diesel cycle is the expansion of the heated medium throughout the remainder of the stroke after the fuel admission valve has closed. This process was to have been an adiabatic expansion in the original cycle. The fourth process is the discharge of the combustion products and the recharge of the cylinder with pure fresh air. This was to have been an isothermal process. The necessity of cooling the cylinders and pistons in the practical engines prevented the accomplishment of the isothermal and adiabatic processes and the attainment of the Carnot or perfect heat cycle, but the approach to it has made the Diesel the most nearly perfect in thermal efficiency of any practical heat engine.

To illustrate the power balance of the stroke, data for the cycle of a 2-cycle engine of large size have given from the indicator card: 500 pounds per square inch initial pressure, 150 pounds per square inch mean forward pressure during the working stroke, 50 pounds per square inch during compression stroke, giving a mean effective working pressure of 100 pounds per square inch.

From 1893 until 1903 nothing of note was undertaken with the Diesel for marine use. At the latter date a small barge of 265 tons capacity was engined with a single motor of 25 B. H. P. From 1903 to 1908 the progress was slow and, in fact, nothing was done at all in marine work in 1906. This slow progress was due no doubt to the non-reversibility of existing types and to clutch difficulties. Beginning with 1908 there were eight vessels completed; five in 1909; sixteen in 1910; thirteen in 1911; and twenty-three vessels completed or to be completed in 1912. The vessels now in operation include vessels from oil-barges of 300 tons, to mail and passenger steamers of 10,000 tons; and speeds of 5 knots to speeds of 14 knots. The foregoing does not include vessels under 100 feet in length, of which there are about 250; nor does it include any naval vessels, though it is well known that the Russian government has had several gunboats engined with Diesel

engines, in service for a number of years; the French and Italian governments have a large number of submarines engined with Diesels: and our own navy has two vessels, E-1 and E-2, in service so engined, and several more under construction. This type of power is being considered for the submarine tender appropriated for by the last Congress.

The English Admiralty has taken up the construction of a twin screw vessel with a turbine and a heavy oil engine on each shaft; the heavy oil engine forward of the turbine and connected to the shaft by a clutch. For high speeds the turbine is to be used, and at low or cruising speeds the oil engine is to be used. This seems to be rather forcing things, as aside from the expensive installation, the value of the results are menaced by the problem of propeller design. In an old cruiser they are removing one engine and replacing it with a Diesel of equal power. In this case a few of the boilers are to be removed, and exhaust is to take place below the water line. This experiment should give valuable data for comparison. In the English navy the first Diesels were installed, for dynamo drive, in the *Dreadnaught,* and since that time every battleship or armored cruiser put in commission by the Admiralty has been equipped with these engines.

The German installation of the 12,000 B. H. P., 6-cylinder, 2-cycle, double-acting engine is now well advertised. It has developed, however, that the vessel for which this engine was intended is now to be completed with turbines, and further that she was designed with full boiler power for a complete turbine equipment. These points may be rather significant as representing a conservative German view. In a test of three cylinders of the 12,000 H. P. engine recently, oil gas from some source was admitted to the cylinder with the scavenging air, forming an explosive mixture, which was ignited and caused an explosion which wrecked part of the engine, killed several men, and caused a serious fire which threatened the entire destruction of the engine. In the absence of other information is is probable that the cause of the trouble was the use of lubricating oil, in the air compressor, from which the lighter distillates had not been removed.

Types, etc.—The steam plant is composed of two main divisions in which the working process is carried out. The boilers furnish the working medium in a state for use in the cylinders of the prime mover. In the Diesel the whole process is dealt with in the

cylinders. For the delivery of the heat energy of the fuel to the working shaft there are the following types and possibilities: (1) 4-cycle single-acting: (2) 4-cycle double-acting: (3) 2-cycle single-acting: (4) 2-cycle double-acting.

A brief discussion of the relative advantages and disadvantages of the basic 2-cycle and 4-cycle types will perhaps shed some light as to which should be preferred for naval purposes. An essential feature of all types is that they require an auxiliary air compressor capable of compressing air to a sufficient pressure to inject the fuel oil into the working cylinder of the engine, a pressure of about 850 pounds to the square inch.

Between the 2-cycle and 4-cycle types the 2-cycle should give at a given speed and the same piston displacement about, though not quite, twice as much power as the 4-cycle. Hence the 2-cycle will give a more compact and a lighter machine than the 4-cycle, for a given power and speed. A special system of scavenging is necessary for the 2-cycle, in order to clear the cylinder of the products of combustion at exhaust, but this clearing-out of the burned gases is more thoroughly done than it is in the 4-cycle, which depends on the idle stroke of the piston for scavenging. This favors the use of a less refined, hence cheaper, oil in the 2-cycle. It is of the utmost importance that the products of combustion be thoroughly driven out of the cylinder, as upon this depends largely the efficiency, reliability, and capacity of the engine.

As for every revolution of a 2-cycle engine there is a power stroke as opposed to two revolutions to a power stroke in the 4-cycle, the 2-cycle is much more readily maneuvered and reversed. Owing to the nature of the cycle the pairs of cranks in a 4-cylinder 4-cycle engine are always placed 180 degrees apart, therefore to provide reversibility in any position at least six cylinders are necessary in the 4-cycle. For a 4-cycle even of six cylinders a fly-wheel is required; this is not necessary in the 2-cycle. Better shaft torque is given by the 2-cycle. For equal power the initial cost of the 2-cycle is from 10 to 25% less than the cost of the 4-cycle, but the fuel consumption of the 2-cycle for equal power is about 10% greater than the 4-cycle. In the 4-cycle the cylinder cover contains an air admission valve, fuel admission valve, exhaust valve, and a compressed-air valve for starting and reversing the engine. In the 2-cycle the cylinder cover contains only a fuel admission valve and a compressed-air admission valve.

The scavenging-air valve may be placed in the cover also, but it seems that for the sake of simplicity and ease in removing the cylinder cover a better place is in the cylinder wall, approximately opposite the exhaust ports which are uncovered by the piston during the latter part of its stroke.

All valves are kept closed by powerful springs and are actuated by cams on a cam shaft, running the length of the engine and driven from the main shaft by skew gearing and a vertical shaft.

In both types the compressed-air admission valves are used only for starting and reversing, and the actuating cams are so arranged that the fuel admission and the compressed-air admission valves cannot be in operation at the same time. By shifting the cam shaft in the direction of its length the proper amount the cams are thrown in for starting, reversing, or whatever operation is desired.

The 2-cycle requires special scavenging arrangements which are usually, though not necessarily so, driven off the main shaft, causing loss of mechanical efficiency; this loss, however, is probably not more than that which is lost in the 4-cycle in driving pistons two idle strokes out of four.

In summing up it seems that the balance is vastly in favor of the 2-cycle, with the single exception of a slightly larger fuel consumption; it is believed that this will be outweighed in the long run by other advantages, however. Relative to the double-acting or single-acting engine the way leads without question to the double-acting as the ultimate type, following the lines of the double-acting steam engine. The difficulties anticipated with the stuffing box have been satisfactorily surmounted; there remains, however, the problem of spraying oil into the bottom of the cylinder for complete combustion without the fitting of at least three fuel admission valves, and thus complicating the gear and cams. This is due to the piston rod occupying the center line of the cylinder.

In the determination of the number of cylinders relative to the best torsion moment of the shaft it has been found that the turning moment of the 12-cylinder, 4-cycle; 6-cylinder, 2-cycle; and the 3-cylinder, 2-cycle, double-acting, give the same uniform turning moment and a superior turning moment to that attained by the usual triple-expansion 4-cylinder steam engine; hence the 3-cylinder, 2-cycle, double-acting will be taken as the unit for propulsion purposes.

For electric-generator drive and necessary auxiliaries for air-compressing, etc., the choice should lie with the single-acting type for the sake of simplicity; as regards the 2-cycle and 4-cycle types the choice should be governed by the conditions that exist at the local point of installation. The 2-cycle presents a more compact and a lighter machine for the same power; the 4-cycle presents perhaps a simpler installation with a slightly better fuel consumption.

Fuel.—The Diesel engine has the advantage of being able to consume oil that cannot be used in engines of lower compression without the aid of special ignition devices, and it can also use oils that are of no value for any other purpose. Some one has very aptly stated that "it can burn any old stuff in the nature of petroleum"; but it can go even farther than this, as fat oils from vegetable or animal sources have been used advantageously without any change in the engine whatsoever. Petroleum can be used in its raw state, as crude oil, in the condition in which it leaves the earth; but for universal use the residual oil after the lighter hydrocarbons have been distilled off is better, as there is little liability of danger from the oil gases. Such oils have a flash point of about 130°C. and can be purchased in this country for about two cents per gallon, or about $4.50 per ton.

Oil of an asphalt base is not entirely suitable for the Diesel engine on account of the liability of a deposit of an unburned residue in the working cylinders and mechanical difficulties of properly supplying the oil through the fuel pipes and valves that will become gummed by the asphalt oil in the presence of heat. Oil of a marked sulphur constituent is also undesirable, particularly in engines having copper or bronze fuel supply pipes and fittings due to the affinity of sulphur for the material of such fittings. However, the problem of the effect of asphalt, sulphur, and water in fuel oil is still more or less of an open question and it is a problem that merits thorough investigation.

In this connection it is noted that there is a deplorable lack of standardization relative to terms used in speaking of fuel oil. Crude oil is the raw oil as it comes from the earth, after the earthy impurities have been strained off, but this term is frequently used to indicate oil that has been freed from its lighter distillates. In Russia real crude oil is known as naphtha. In England petroleum is known as paraffine, and on the continent of Europe the oil

produced by the distillation of brown coal is known as paraffine. This promiscuity of terms is confusing at best.

Fuel Consumption.—In the smaller sizes of Diesel engines manufacturers guarantee a full load consumption of .50 of a pound per brake horse power; at ¾ load .52 of a pound; at ½ load .60 of a pound; and at ¼ load .80 of a pound. These are conservative claims and in larger sizes the economy is greater, but the increase in size does not bring increased economy in the same ratio that it does in the steam engine; but this is of small moment in comparison, considering the marvelous economy attained by the Diesel. To show the margin of safety in the manufacturers' guaranteed claims, every-day figures for an installation of moderate size give .44 of a pound per brake horse power at full load; .45 of a pound at ¾ load; .47 of a pound at ½ load; and .62 of a pound at ¼ load. These figures are not a record, but are figures for every-day performance under actual running conditions. A recent battleship on her trials gave 12.6 pounds of water per I. H. P. at full power, which at a mechanical efficiency of 85% gives about 14.8 pounds per B. H. P. The actual evaporation was 11 pounds of water per pound of coal, exceptionally good, which gives 1.3 pounds of coal per B. H. P. at full power. This is exceptionally low consumption, but when compared with .50 of a pound in the Diesel there is a ratio of approximately 1 to 3. This consumption at full power in the Diesel is not exceptional. At the battleship's economical speed the ratio becomes 1 to 5 in favor of the Diesel at that speed. Equal storage capacity will take about one-fifth more oil than coal, and for the vessel in question the radius will accordingly be increased about six times by the installation of Diesel motors of equal power, at the economical speed of the steam engine.

As to the weight of the Diesel engine, a slow-speed, heavy machine of 150 R. P. M. full power including all necessary auxiliaries will weigh about 100 pounds per B. H. P. This gives a sturdy machine with no delicate construction whatsoever, or introducing the complication of incessant watchfulness of bearings while in operation. The present steam installation of a battleship will run about 210 pounds per B. H. P. The vessel taken for this comparison is the *South Carolina* with an I. H. P. of 18,250, or at a mechanical efficiency of 85% about 15,600 for effective horse power. Her propelling plant may be replaced by two double-acting 2-cycle engines of a total horse power

of 20,000, or three double-acting 2-cycle engines of 18,000. This refers to brake horse power in each case. The only reason for installing three engines and three shafts instead of two would be for the better control of the ship at dead slow speeds. At the present state of the development of the Diesel engine, on account of the necessity of the high heat of compression for the proper ignition and combustion of the fuel, the usual slow speed guaranteed is one-third speed, although by cutting out certain cylinders one-fourth speed has frequently been easily maintained; this would be about 38 R. P. M., or say five knots per hour, with a two-engine installation and the *South Carolina's* present propellers. Assuming the first installation of two engines, 20,000 brake horse power, 4400 more than the present steam installation. a saving in weight of 611 tons of machinery is at once realized. For an installation similar to that of the Italian and French submarines actually installed and operating, the engines weigh about the same as steam engines of like power, including all engine auxiliaries of each installation. The weight of all boilers and necessary accessories is thus saved. A note in one of the technical journals a short time ago gave a French estimate on one of the old French battleships in which a saving of weight of 400 tons and three-fifths of the machinery space would be realized by an equipment of Diesel engines.

Relative to space, the engines will occupy a floor space of approximately 50 feet by 18 feet, and will stand about 26 feet high. This floor space will not include the air compressors for fuel supply, reversing, and starting, but will include the necessary scavenging cylinders driven off the main engines by connecting levers to the crossheads, similar to the manner in which air pumps were formerly driven. The air compressors will be driven by separate Diesel engines of about 300 horse power each, and may be placed where most convenient in the engine room. The engine rooms will be a little larger than at present, but almost all of the boiler space and bunkers will be entirely free from use with the propulsive plant.

The speed of revolution will be about the same as at present; hence the propeller efficiency will remain unchanged.

As to reliability, Diesel engines are running long non-stop runs and tests of much longer duration than they will be required to perform in actual service. A recent concrete example at hand is

a 30-day non-stop test of a 2000 horse power 4-cycle engine in Scotland, the engine being found in as perfect condition at the finish of the test as it was at the beginning. Numerous similar examples may be found. At the Birkdale, England, electric works there is a Diesel engine that has been in operation for the last four years on an average of 23¾ hours out of every 24 during that entire period, being stopped 1½ hours each Sunday. This engine is a Mirrless-Diesel built by the firm that has supplied these engines to the British Admiralty for generator drive and other purposes. A further exhibit noted in the discussion of J. T. Milton's excellent paper on Diesel engines for ship use, is of two Diesels, 80 horse power each, of seven years continuous service; out of which time they were in actual operation 36,000 hours without a thorough overhaul. They were finally completely dismantled and found to be in excellent condition and were put together again with very little work. During the three years immediately previous to dismantling, the repairs to the two engines, which consisted mainly of replacing valves, aggregated about $60.00 per year. The fuel consumption at the time of overhaul was .43 of a pound per brake horse power at 80% load. The above seem to be fair examples of upkeep and reliability.

Relative to the handling of the engines, tests of certain installations have shown the time from full speed ahead to full speed astern as 3 seconds, and full speed ahead to stop or the reverse 2½ seconds. This was for a small plant, but for the *Selandia's* engines of 1250 horse power the time from full speed ahead to full speed astern or the reverse is 20 seconds. This is for a 4-cycle single-acting type, and is longer than the time for the same maneuver in a 2-cycle single- or double-acting type. An Italian test of a unit for a 6-cylinder, 2-cycle, double-acting engine designed for 12,000 horse power gave reversal tests of 6 seconds. A table from the *Engineer* relative to practical results derived from a comparative test of two marine installations of the same power, one of steam and the other Diesel motors, gave the following:

	Steam.	Diesel.
1. Engine from stop to ahead or astern.....	4/5 sec.	2/5 sec.
2. Engine from full ahead to full astern.....	15 sec.	8 sec.

Maneuvering tests have been conducted and from 40 to 50 maneuvers carried out per hour with the greatest ease and reliability. No difficulty should be experienced in speed regulation, as there

are thousands of stationary Diesel engines running daily where the revolutions are governed to within one or two per cent by automatic governors; this is as good as is done with steam. For a marine plant it seems that the governing should be done entirely by hand and that the speed regulation should, if anything, be accomplished more readily and reliably than in the steam engine. The oil is always ready for use and the amount going into the cylinder and the pressure of the injection air can be regulated with the greatest accuracy. In the steam engine the operator is dependent upon the boiler pressure, which at best is not constant. Further in this connection, there have been many harassing experiences in the fleet for the engineers of the watch when getting under way to join formation, and a call comes suddenly for a comparatively high rate of speed from a dead stop. It is usually a case of fight to build up the power and it is a long hard pull before it comes. In the Diesel the power is always right at hand and only needs to be used by the setting of a small hand wheel or lever. From full speed ahead to a sudden stop there is no hurry and scurry to control a high steam pressure. The proper power developement is not dependent upon the skill of many men throughout the department, but solely upon the proper adjustment of the fuel supply by a single operator at each engine.

Continuing further with the comparison of the *South Carolina* numerous other features will follow with the introduction of Diesel power on her with the entire elimination of steam. Electric power will be used for all auxiliary purposes, such as winches, ammunition hoists, sanitary and bilge pumps, steering gear, galley, etc. Water-circulating and forced-lubrication pumps for the main engines are also electric-driven, as in the case of securing the main engines it is advisable to continue the circulation to allow all parts to cool gradually; also, if oil is used for cooling the main pistons, the high heat stored in these pistons will be transmitted to the oil in the circulating passages and cause deposits by decomposing the oil, unless it is kept in circulation after the engine has stopped. A standby air compressor electrically driven should be placed in each engine room in case of loss of air for the main engine and auxiliaries. The application of electric power throughout the ship can be accomplished on the present dynamo plant of four 200 K. W. machines. The present turbines as the prime movers of the generating sets will be replaced by 2-cycle, single-acting engines

of about 280 horse power, weighing about 90 pounds per K. W. and running at 300 R. P. M. This is a substantial, comparatively heavy slow-speed machine, and at full power should consume about .45 of a pound of fuel per horse power, or say at a usual 50% power factor .50 of a pound per horse power. This fuel economy over the present dynamo plants on ship board will remove one of the most potent factors in the argument favoring the installation of alternating currents on our ships. The placing of these complete separate generating units in the dynamo room, removal of all steam lines, condensers, etc., tends to reliability, simplicity, and elasticity in the location of power units, also a high percentage of saving of weights. In the engine and boiler rooms the following will be eliminated: condensers, feed tanks, and all accessories, feed pumps, feed heaters, boilers, auxiliary feed pumps, forced-draft blowers, super-heaters, ash expellers and accessories, coal bunkers, coal, ashes, ash-hoisting apparatus, all firing tools, etc.; stores and store rooms will be simplified, and the water-tight door system simplified. Other changes throughout the ship are numerous, some of them being the abolition of smoke pipes, fire room ventilators, fire room hatches, all coal-handling gear, trucks, booms, etc., all coal chutes, and enormous hatches. There will be no steam pipes or steam leads of any sort except such as may be required for heating living compartments, or for the evaporator installation. The evaporator plant will be much smaller, as with the abolition of the boilers there should not be a demand for a make-up of over 10,000 gallons per day at the maximum. This does not take into consideration the lessened demand of the personnel due to the reduction of the fire room force, who by the nature of their employment require large quantities of water daily. For the evaporators the heat of the exhaust of the dynamo engines may be utilized, but this is a little problematical. The two problems that seem to present difficulties are the heating of the living compartments and the operation of the whistle. It is possible that a heating plant similar to that of any large apartment house could be used, or the heat of exhaust gases; perhaps electric heating will be the simplest solution. For the whistle it has been found that compressed air gives a sound superior to steam, but it does not give the visibility that is so valuable in steam, though not called for by the rules of the road; also in cool weather there is danger from freezing due to the expansion of the air through the whistle.

The engineer force will be much reduced, repairs and upkeep will be simplified and standardized. The vessel's radius will be increased at full power about four times, and at economical speed about six times, the engines will always be ready for instant service with no stand-by losses whatsoever. Tests made with a cold Diesel engine were carried out in which in 6 seconds from the time of the first operation to start the engine it was at full power and taking its full rated load. The ship will be able to take her full power speed at the instant of getting under way, and maintain it to the limit of her fuel endurance, which is a thing that no battleship in existence can do, unless her fuel allowance is entirely in oil and she can carry enough fresh water to take care of the make-up feed. A statement of a more or less *ex-cathedra* nature has been made to the effect that no steam-driven ship can be driven to the limit of her fuel endurance at full power owing to the enormous water losses. But even so, laying aside the question of water endurance, it is probably beyond the limits of physical endurance for the personnel of the engineer department of a steam-driven man-of-war to run her to the limit of her fuel capacity.

We have then in the final estimate the following favorable points of the Diesel engine: (1) The construction of the engine is simple and strong; each cylinder is an independent unit, developing its proportional share of the engine's power; the operation of the machine is simple and reliable. (2) Economy of fuel gives an increase of from four to six times in the radius, and the actual cost is two or three times cheaper. (3) Does away with smoke pipes, boilers, steam pipes and leads, and all of the many and various accessories of a steam plant, their repairs and the personnel for their up-keep and operation. (4) The engines are always ready for operation immediately, and all stand-by losses are eliminated. (5) All parts of the power equipment can be made standard; hence repairs are simplified and time spent in repairs greatly shortened. There should not be any more trouble with the main engines of a battleship than exists at present, and it does not require much imagination to estimate the ease of up-keep if everything in the way of machinery in the propulsive department of a battleship should be wiped out except the main engines. (6) Engine room temperatures are much reduced, being little above the temperature of the outside air; in fact, it is anticipated that the engine room will be supplied with heat for the comfort of the personnel. (7) The

abolition of boilers and smoke pipes will greatly simplify the location of turrets and the stowage of ammunition. (8) The abolition of coaling hatches, fire room hatches, ventilators, and coal bunkers will simplify construction. (9) Absence of smoke; the exhaust should be practically colorless and odorless, as the combustion in the working cylinders is perfectly complete with proper fuels. (10) The oil fuel itself brings many advantages; viz., (a) rapid and cheap loading of fuel, (b) entire absence of dirt and dust, (c) elimination of ashes and cinders, and gear for handling them, (b) capability of storage in compartments ordinarily of little value as storage space, (e) no waste of space in storage compartments, (f) absolute safety of residual oils on ship board, no danger from spontaneous combustion or conflagration. Tests conducted with explosive shells against tanks containing fuel oil have produced no combustion. Should a double-bottom fuel-oil compartment be pierced by an explosive shell or torpedo, the absence of the necessary heat combined with a sufficient amount of oxygen would prevent combustion. (g) Oiling at sea is a comparatively simple operation and can be conducted under unfavorable weather conditions. Coaling at sea is almost an exact science. Togo would have waited in vain in the Sea of Japan, had he been opposed by a fleet of Diesel-engined vessels with their enormous radius of action and easy means of refilling their oil tanks. (h) One pound of oil in the working cylinder of a Diesel engine will do four times the work of an equal amount of coal in the furnace of a steam boiler. It seems a brutal waste of energy to burn bituminous coal if it can be made to yield, by distillation, suitable oil for heavy oil engines.

Some of the disadvantages noted have been: (1) The need of frequent cleaning of cylinders; this has not been borne out in practice and the attention given the marine steam engine in the naval service should be sufficient. (2) Cost of oil will go up as the demand increases and that the world's supply is limited; this is answered by the fact that the present price of residual oil is governed by the price of its distillates, gasoline, kerosene, etc., and by the fact that the price of coal has not increased in proportion to the increased demand in normal times. Hence such an argument against oil does not appear to be sound. Further, the ease with which oil is produced as compared with coal makes the likelihood of the supply of oil being entirely stopped by industrial troubles such

as have gripped England and other European countries and threaten this country at times, seem to be quite remote. The inability of the Navy Department to secure coal cargoes for the period of time that the recent coal troubles menaced England would seriously hamper the operations of our fleet, especially on the Pacific coast. As to the supply of oil, new fields are being discovered and the present supply of oil is believed to be as extensive as the supply of coal. Diesel engines consume oil one-quarter as fast as coal-burning vessels consume coal; therefore we seem to be safe on that score, even if there were three times as many motor ships as coal-burning ships. The applicability of animal and vegetable oils to the Diesel furnishes another field from which fuel way be drawn that is not open to the steam plant. The United States is especially favored in the oil supply, as at the present time this country produces 90% of the paraffine base oils, which is the oil par excellence for use in Diesel engines. (3) Danger from explosion and spontaneous combustion; the residual oil from which the lighter hydrocarbons have been distilled is absolutely safe, safer than coal.

One disadvantage that is seldom, if ever, mentioned is the cost of the Diesel installation. The first cost is extremely high, costing more than a steam plant of equal power including boilers, engines, and all accessories. This is no doubt higher than will be the future cost, but the workmanship and materials must be of the best to stand the continuous high pressures and temperatures. Other objections have been: (a) danger from racing in a heavy sea, but that hardly seems valid; (b) the helplessness of the plant due to loss of air; that objection also seems a little forced, especially in an installation where the personnel is of a high order. The loss of air is not any more likely than the loss of vacuum on a steam vessel, and a more helpless machine than a high-power steam vessel with no vacuum on her condensers would be hard to find.

The progress of the Diesel engine will no doubt be greatly accelerated by the recent expiration of the original Diesel patents. The strides taken in the past two or three years have been enormous, and it is most instructive and enlightening of the futility of human prediction to read articles written by engineers of note and published in the columns of leading technical journals about five years ago, in which it was asserted, with the figures to prove, that the power and size of the Diesel engine could not go above certain

proportions; the proportions were surpassed before the figures had become cold. The impossible was accomplished while it was still impossible.

The steam turbine is a step between the steam and the oil reciprocating engines, and perhaps in time the reciprocating oil engine will make way for the oil-or gas turbine. The progress so far has been so logical, proceeding from complexity to simplicity, that further simplicity does not seem unreasonable; it may be that the province of the perfect heat cycle itself will be threatened.

THE FUNDAMENTALS OF NAVAL TACTICS.

By Lieutenant Romeo Bernotti, Italian Navy.

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CHAPTER V.

Torpedo-Boat Maneuvers.

66. *Characteristic Conditions of the Attack of Torpedo-Boats.*—In the study of the maneuvers of ships opposing each other we have logically held that at all times each of the adversaries seeks to maneuver opportunely; but the essential characteristics of the nocturnal attack of torpedo-boats are surprise and high speed; hence we do not reason in an entirely aprioristic way when supposing that while the torpedo boats execute the maneuver of approach, the ship attacked continues on her course. It would, however, be erroneous to deduce from this that the maneuvering reduces itself to solving a simple problem in kinematics; indeed it is necessary to keep in mind the conditions of extreme uncertainty that are realized in practice. With the assistance of Daveluy (*op. cit.*) let us fix our thoughts upon the difficulties that a torpedo-boat encounters in attacking a ship in motion.

The enemy is sighted in the form of a black mass. The torpedo-boat must take account of the direction in which its objective is moving, and then gain an advantageous position for the maneuver of approach; that is to say, a position from which, steering to arrive at launching distance, there may be assured to the torpedo a convenient angle of impact.

This is very easy to define but very difficult to realize. When, on sighting the ships, one is not in the aforesaid advantageous position, in order to gain it one risks losing the benefit of the surprise; and for the rest, it is not easy to know whether one is or is not in an advantageous position; one is led by this to steer to approach the enemy's mass, which is hardly distinguishable, reserving it to himself to maneuver afterwards as he may.

In general, then, we cannot succeed in solving the problem of approach in a theoretically exact manner; moreover, when we have taken account of the direction in which the enemy is moving, we still shall not have succeeded in estimating his speed, nor may

we rely upon making this estimate in time; which would be necessary in order to construct the triangle for launching the torpedo.

From such conditions of uncertainty results *the necessity of launching from a very short distance.* The improvements made in the torpedo are to be considered as important, not because they give the means of launching, for example, at 1000 meters instead of 500, but because they confer upon the torpedo launched at the latter distance a higher speed than it had before, and hence a greater probability of hitting.

The results obtained by the Japanese torpedo-boats after the battle of Tsushima did not depend alone upon the fact that the artillery battle had deprived the surviving Russian ships of a part of their means of defense, but were due to the close and vigorous manner in which the attacks were conducted. Togo, in his report of the battle, expresses himself in this connection in the following words: "According to information gathered from the prisoners, the attacks of the torpedo-boats during the night were extraordinarily impetuous. They hurled themselves at such speed and approached so rapidly that it was impossible to stop them; they came so close that the guns of the ship could not be sufficiently depressed in order to hit them."

While it is necessary to remember that the real conditions of the torpedo-boat attack will be those just mentioned, this does not exclude the advisability of reflecting upon the theoretical conditions of the maneuvering, considering them as the limit toward which we must tend. The general criterion of launching from a short distance being established, in the following reflections we shall hold that the run c to be considered as normal for the torpedo in a night attack of torpedo-boats is that of 500 meters.

67. *Maneuver of Approach.*—It is well known that the rules which practically apply for the maneuver of approach can be formulated as follows: 1st. If the torpedo-boat finds itself to one side of the ship, it must steer as if it desired to meet that ship (section 32, I) (lateral attack). 2d If the torpedo-boat finds itself almost exactly ahead of the ship, in approaching it should move somewhat to one side, and afterwards steer a course opposite that of the ship (attack in passing on opposite courses). When the torpedo-boat sights the ship in a stern sector, since the lateral attack would be too long, it must first, without approaching so as

to be seen by the enemy, gain a convenient bearing and then maneuver as in the first case.

We do not desire to create complications by seeking for different rules, but we propose to fix our minds on the rules alluded to; observing that, from what we have set forth in section 32, their theoretical exactness might be placed in doubt; and we now wish to demonstrate that these rules are very nearly exact.

1st. If V_N is the speed of the ship N that it is desired to attack, and v is the speed of the torpedo, as we have already had occasion to note in section 9, the geometrical locus of the positions from which the launching may be executed in such a way that the torpedo may strike the ship after a run c is obtained by making NN_1 (Fig. 42) equal to $c\,\frac{V_N}{v}$, describing a circle with a center at N_1 and with a radius c, and then limiting to right and left of the ships the arcs—as SS'—included between the straight lines, passing through N_1, that form angles of 30° with the course.

The theoretically exact maneuver for the approach would then be the one for arriving on the arc SS' in the shortest possible time. Setting aside the angle of impact, the problem of kinematics is that of bringing oneself in the minimum time to a distance c from the imaginary point N_1; and hence, if the maneuver could be executed with theoretical precision, from what we said in section 32, II, on arriving at launching distance in the shortest time, the torpedo-boat should find N_1 in the direction of its bow. In other words, the maneuver of approach should be executed in such fashion that, if the torpedo-boat had a bow launching tube, on arriving at launching distance it should have no need of changing direction in order to execute the said launching. We note this circumstance in order to fix the idea, and not because we at-

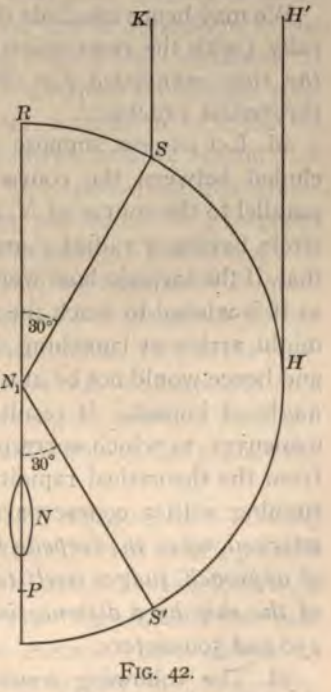

FIG. 42.

tribute to it any special importance; the bow tube being generally abolished.

So, then, in order to arrive in the minimum time at the distance c from the imaginary point N_1, it would be necessary to maneuver (see section 32) as if it were desired to reach a point P, which is moving at a speed V_N and situated astern of N_1 at a distance

$$N_1P = c\frac{V_N}{V_T},$$

V_T being the speed of the torpedo-boat.

On the basis of the value of NN_1 above mentioned, the point P is distant from N a length $NP = N_1P - N_1N = c\left(\frac{V_N}{V_T} - \frac{V_N}{v}\right)$.

Evidently the distance NP is very small; so, putting $\frac{V_N}{V_T} = 0.8$ and $\frac{V_N}{v} = 0.5$, we have

$$NP = 0.3c = 150 \text{ meters.}$$

We may hence conclude that, *besides being easily applied practically* (with the reservation mentioned in the preceding section), *the rule enunciated for the lateral attack is also very near to theoretical exactness.*

2d. Let us now suppose the torpedo-boat to be in the zone included between the courses HH' and SK, both of which are parallel to the course of N, and the first of which is tangent to the circle having a radius c and its center at N_1. It is readily seen that, if the torpedo-boat were to execute the maneuver of approach as if it wished to reach the point P or the center N of the ship, it might arrive at launching distance at some point of the arc SR, and hence would not be in a position for launching with a sufficient angle of impact. It results from this that the sure and simple maneuver, to which corresponds a rapidity of approach differing from the theoretical rapidity by a negligible quantity, consists in running with a course parallel and opposite to that of the ship attacked, *when the torpedo-boat, at the beginning of the maneuver of approach, judges itself to be laterally removed from the course of the ship by a distance included between c and $\frac{1}{2}c$, or between 450 and 500 meters.*

3d. The following considerations are sufficient to show the necessity for the torpedo-boat to avail itself of its greater speed

in order to gain a position in a forward sector of the enemy's ship when the latter is not sighted from such a position.

The danger zone for a torpedo-boat is naturally that in which there is great probability of being hit by the guns without being able to launch a torpedo. Since we are referring to a night attack, the range of the anti-torpedo-boat guns—that is to say, the radius of the danger zone—may be held to be about 2000 meters; and it is to be noted that the distance at which the torpedo-boat sights the ship is often not greater than this. The inferior limit of the danger zone is constituted by the circle with its center at N_1 and the radius c (Fig. 42), which circle moves with the ship at a speed V_N.

So, then, it is clear that the further forward is the bearing on which the torpedo-boat begins the approach, the more rapidly will it traverse the danger zone, for two reasons: I. The relative speed being so much the greater, so much the more rapid will be the variation of the distance. II. So much the greater will be the distance at which the launching can be executed. It may be noted that in giving importance to this we are not in opposition to the criterion established—that of launching from a short distance. It is very true that we may not pretend to diminish the danger zone by launching the torpedo for a long run, because in so doing we should obey a mistaken defensive sentiment, and we should risk rendering our offense inefficacious. The torpedo-boat that thinks of protecting itself instead of attacking vigorously is a torpedo-boat lost without having accomplished anything. But in the case under discussion the situation is different; the term *short distance* must be precisely understood in the sense of *a short run for the torpedo;* and the further forward (up to the line SK) is the position of the torpedo-boat, so much the more may we launch from a distance, the run of the torpedo remaining as short as has been established, without having a notable difference in the probability of hitting.

68. *The Maneuvering of a Flotilla of Torpedo-Boats.*—Owing to the characteristic difficulties of the torpedo-boat attack pointed out in section 66, it is necessary that the attack be executed by a certain number of units; there being thus the possibility of producing uncertainty in the firing of the enemy, who is obliged to distribute his offense among the different targets; and permitting the hope that the number may remedy the scant probability of

individual success. Nevertheless, as Commander Vannutelli has observed (*Rivista Marittima* for May, 1910), it is well to consider the following axioms:

1st. The probabilities that the torpedo-boats will be hit before arriving at launching distance increase with the compactness of the order of attack; since, when the torpedo-boats are very close together, they constitute a single, extended target, easily visible; and, *vice versa*, they diminish with the increase in the dispersion of the torpedo-boats in the direction normal to the line of fire.

2d. The same probabilities increase with the increase in depth of the order of attack of the torpedo-boats in the direction of the bearing of the ship; that is, they are maximum when the various units keep on or near the same bearing from the ship, thus exposing themselves to raking fire. It results, therefore, that it is necessary for the torpedo-boats to have a suitable dispersion, and to arrive at the launching position simultaneously rather than successively.

But the length of the chord SH (Fig. 42) is equal to 500 meters, the angle SN_1H being 60°; we deduce therefrom that the maximum number of torpedo-boats that may *simultaneously* attack a ship from one and the same side, to the end that they may be properly separated, must be held to be *three*.

Having to aim at simultaneity of attack, the torpedo-boats of this group, in distancing themselves from each other for the execution of the maneuver of approach to the ship, must arrange themselves on an alignment normal to the line joining their center with N_1; thus also satisfying approximately the second of the axioms just enunciated. It can be established as a practical rule that the alignment may possibly be normal to the line joining its center with a point a little ahead of the ship to be attacked (the further ahead, the higher is the speed V_N).

From this alignment, the torpedo-boat occupying the central position may begin its maneuver of approach as if it were alone; and the others must follow a course parallel to it.

The action of one of these groups, which attacks the ship on one side, evidently favors the attack of a similar group on the opposite side, if this is made after a very short interval of time; since, from the moment in which it is discovered, it may be predicted that it will absorb practically all the attention of the enemy.

There is thus developed the advisability of constituting squad-

rons of torpedo-boats of six units, divided into two sections, destined to maneuver for the attack separately but co-ordinately.

Evidently, the attack of the sections on the two sides can be made on condition that the squadron, on sighting the ship, finds itself on the line of the course of the latter; otherwise the sections will attack successively; it may be presumed that the first attack, if it does not succeed, will be an efficacious preparation for the second; because, in the minutes following, there will be a relaxation of vigilance.

Such seem to be the guiding criteria, not excluding that it may be advisable to depart from them under special circumstances, in order to adapt oneself to the movements of the enemy, if he moves as the searchlights are directed, toward the number and position of the torpedo-boats illuminated.

The employment of several squadrons against a fleet of ships requires as a preliminary condition the envelopment of the enemy; that is to say, taking the position with the squadrons in different points of the horizon so that the adversary cannot withdraw from the attack. But it is needless to say that the problem of envelopment ought not to be considered a problem of kinematics; criteria for its solution cannot be pre-established, because the envelopment is to be held possible only when the adversary's fleet is occupied in an artillery battle. Typical conditions for a general attack are those described as follows in the already cited report of Togo: "Night was beginning to fall. Our torpedo-boat squadrons had already enveloped the enemy to the North, East and South. Consequently the principal squadron ceased fighting and withdrew at sunset."

69. *Tactical Action by Day.*—Let us recall to mind the beginning of the battle of August 10, 1904. The Russian squadron saw numerous torpedo-boats ahead, and, fearing that they might have thrown out blockading mines, changed course 90°. An action of such nature, which obliges the enemy to make a movement not required by the situation with respect to our battle forces, may be of great assistance to us.

A movement of destroyers directed so as to arrive at launching position may evidently be admitted against damaged ships, as was done at Tsushima against the *Souwaroff;* it may not be excluded with uninjured ships, on condition that the two principal fleets are not very far apart. Indeed, by day, the danger zone for torpedo-boats is so extended, and the fire of the medium artillery is so

precise, that the launching would have to be executed from a very long distance; and since, under such conditions, there is very scant probability of success, it is not worth while to expose the torpedo-vessels. When, however, the distance from the enemy is relatively short, that is, when, for example, the two fleets are fighting at close range, if nothing else is accomplished, the torpedo-boats will oblige a part of the enemy's ships to make a movement not required for its tactical employment with respect to the battle fleet; which may produce important consequences.

70. *The Maneuvering of a Submersible.*—A submersible, for an attack by day, finds itself in conditions analogous to those of a torpedo-boat in a night attack, with the added disadvantage of its inferiority in speed with respect to the ship. It must submerge at a distance of about three miles from the ship and steer for the approach; rectify the course by emerging the periscope, and then execute the launching. We propose to determine the sector in which the submersible should be found with respect to the ship at the moment of approach, in order that conditions making it impossible to arrive at launching position may not exist.

Let us suppose that the submersible executes the maneuver of approach according to the first rules indicated for a torpedo-boat; that is to say, it steers as if it wished to meet the ship.

Let a be the polar bearing we are seeking, or, the maximum angle that the ship-submersible joining line may make with the course of the ship in order to permit of approaching. Let us indicate by V_N and V_s the respective speeds of the ship and of the submersible, and, naturally, let V_N be greater than V_s.

From section 32, I, there results

$$\sin a = \frac{V_s}{V_N} ;$$

and hence for $\frac{V_s}{V_N} = \frac{8}{12}$, we have $a = 42°$; for $\frac{V}{V_N} = \frac{8}{16} = \frac{1}{2}$ we have $a = 30°$.

With the course of reasoning of section 67, in Fig. 42, we obtain

$$NP = c\left(\frac{V_N}{V_s} - \frac{V_N}{v}\right).$$

Making $\frac{V_N}{v} = 0.5$, we have:

$$\text{for } \frac{V_s}{V_N} = \frac{8}{12}, \quad NP = c;$$

$$\text{for } \frac{V_s}{V_N} = \frac{1}{2}, \quad NP = 1.5c.$$

The value of the distance NP is not, then, as small as in the case of a torpedo-boat; and this leads us to ask ourselves how much α may be considered as increased with respect to the values previously deduced, admitting—but not conceding—that the submersible might succeed in maneuvering in a theoretically exact way for arriving at launching position in the minimum time.

If α' is the polar bearing on which the submersible S would be seen from the point P in Fig. 42, the exact value of α is evidently that which corresponds to

$$\sin \alpha' = \frac{V_S}{V_N};$$

that is to say, there must be assigned to α' the values already deduced for α.

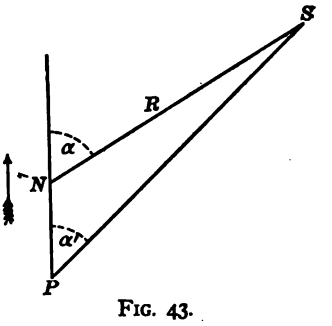

FIG. 43.

Indicating by R the distance NS (Fig. 43), at the beginning of the maneuver of approach, from the triangle NPS we have

$$\frac{NP}{R} = \frac{\sin(\alpha-\alpha')}{\sin \alpha'},$$

from which, substituting for NP and for $\sin \alpha'$ their values, we obtain:

$$\sin(\alpha-\alpha') = \frac{c}{R}\left(\frac{V_N}{V_S} - \frac{V_N}{v}\right)\frac{V_S}{V_N},$$

or

$$\sin(\alpha-\alpha') = \frac{c}{R}\left(1 - \frac{V_S}{v}\right).$$

For the two cases previously considered, the values of $\frac{V_S}{v}$ are respectively $\frac{1}{3}$ and $\frac{1}{4}$; introducing them into this formula, and putting $c = 1000$ meters and $R = 5000$ meters, we get:

for $\frac{V_S}{V_N} = \frac{8}{12}$, $\alpha-\alpha' = 8°$; and hence $\alpha = 50°$ (about);

for $\frac{V_S}{V_N} = \frac{1}{2}$, $\alpha-\alpha' = 9°$; and hence $\alpha = 39°$ (about).

If, then, a submersible is signalled at a distance R from the ship, in order to prevent it from arriving at launching distance, it is

sufficient for the ship to change course through an angle that reaches the maximum values above mentioned.

This is not to be understood as denying the importance to which a submersible may rise—it seems to us that, under present conditions, we may deduce that, instead of relying upon its own manœuvering, the submersible ought generally to wait for the enemy to pass within range; that is to say, *lie in ambush.*

Let us express ourselves in the words with which an American writer closes an important paper on the subject.* "The submersible is a slow and clumsy animal, but its bite is mortal. Keep out of its way. In any case it is not as likely to get you as we have been led to believe."

* PROCEEDINGS OF U. S. NAVAL INSTITUTE, Vol. XXXI.

PART III.

TACTICAL ACTION AS A WHOLE.

CHAPTER I.

Preparation for Tactical Contact.

71. *Route Formations.*—The route formation of the main body of the forces must be established with reference to the possibility of tactical contact with battleships and of attack by torpedo-boats.

As we have already had occasion to point out in section 38, one must bear in mind the necessity of not stretching out the ships of the line in chain; that is to say, they must be kept compact.

Like a fight at close quarters by day, so a night encounter between battleships will certainly not be desirable for the party that is the superior, owing to its interest in avoiding situations in which the unforeseeable is dominant; but it may be advisable for the one who desires to attempt a desperate stroke. It is necessary to guard against such an event, a constant rule being that of not supposing the enemy to be amenable to our designs. Consequently, in order to establish the criteria by which the route formation should be inspired, let us fix our minds on the modalities of the night encounter.

The struggle at close quarters can be its only efficacious form; for this the considerations set forth in section 65 are of value, according to which considerations the route formation must have as a basis the column of vessels, echeloning the ships from it according to the way in which the enemy presents himself. The considerations therein developed must be admitted *a fortiori*, because, naturally, by night, still more than by day, it is indispensable to reduce signals to a minimum and to avoid confusion.

We must hold with Labres (*op. cit.*) that the action of the two fleets will cease when they have passed each other, since a second encounter would imply an inversion of the courses, which must be excluded, owing to the difficulty of recognizing the ships of the two parties. But one must still put himself in condition to draw profit from the disorder of the enemy after passing him. For this

purpose it is well to dispose the forces in two divisions, with sufficient distance between them, so that they need not trouble themselves about the movements that, for each of them, may result from the encounters with the ships or the torpedo-boats of the enemy; these two divisions can then attack in succession.

In this way there is established *the advisability that the principal forces, if numerous, be divided at night into two divisions, rather than massed in a single assemblage.*

The route formation of each division in column of vessels is also the most opportune, having regard to the attacks of torpedo-boats. In fact it is well to observe that the maneuvering of the torpedo-boats will be directed toward executing the attack in such a way as to remain the shortest possible time under fire; therefore, the torpedo-boat will execute the attack upon the first ship that presents itself; and only in the improbable case that he may decide it to have been put out of action will he launch himself against the following ship.

Bearing in mind the characteristic conditions of the night attack of torpedo-boats (section 66), we must recognize that, practically, it is not possible for the torpedo-boats to make a choice of the objectives when the latter are composed—as we now suppose—of ships in motion. The route formation in column of vessels permits, then, the following advantages:

1st. The probability that the torpedo-boats may be in position to attack with opposite parallel courses is rendered minimum; and if this happens, the ships can fire ahead by moving freely out of the column of vessels and toward the opportune side as much as may be necessary.

2d. The maximum defense can be put forth against torpedo-boats sighted off the beam.

3d. The torpedo-boats are also placed in the worst conditions for the withdrawal after launching the torpedoes.

When cruising by night as well as by day in a zone in which the presence of numerous torpedo-boats is probable, aside from the measures for safety of which we shall speak, it must be deemed advisable to navigate at high speed. In fact, the higher the speed, the smaller—as is well known—is the probability of hitting with the torpedo, and the greater the difficulties for the torpedo-boats of executing the maneuver of approach under good conditions.

The cruising system just indicated is applicable, whatever may

be the conformation of the sheet of water that is being crossed. The relative positions of the groups are to be determined according to circumstances; such positions may vary from that in which one division follows the other at a distance, to that of two columns abreast with an interval between the columns of four or five miles; that is, which permits of putting the light artillery and the searchlights freely into action. It is naturally understood that the running lights are obscured, and that the searchlights must be put into action only when the presence of hostile torpedo-boats is signalled.

As Commander Sechi justly observes,* in employing the searchlights "to explore the horizon at more or less frequent intervals, one offers great facility to hostile torpedo-boats; because it is much more difficult for them to find the ships and make sure of their identity than to assail them after having discovered them."

The above-mentioned formation is the one that evidently serves best from the point of view of safety in navigation; it facilitates maneuvering and secrecy, enabling signals to be transmitted between the successive ships of each division by means of a flashlight, visible in a limited sector.

For communication between the two divisions of the naval force the best means of signalling seems to be that of wireless telegraphy, because any others might more easily serve to summon the enemy's torpedo-boats.

The question of the order in which the ships should open fire presents no difficulties with the adopted formation, each ship having a clear field of fire in case of lateral approach, and being easily able to echelon themselves in case of sighting the enemy in the direction of the course. The important thing is that the orders given to the units detached from the main body shall guarantee that the ships or torpedo-boats sighted are those of the enemy; if this necessity is satisfied it can be established that every ship shall open fire as soon as it sights the enemy.

By night as well as by day, the cruising order to be considered as normal for a section of torpedo-boats is that of a triangle of suitable shape, in order that one torpedo-boat may not be enveloped in the smoke of another. The triangular disposition confers the maximum safety in navigation, renders communication easy, avoids the elongations that are produced in the column of vessels, lends itself to the assumption of the opportune alignment

* *Elementi di Arte Militare Marittima*, Vol. II, page 420.

for the attack, and, finally, it permits of grouping in the minimum space, or it is adapted to keeping the torpedo-boats under the support of the ships.

It may be advisable for a flotilla to navigate with the two sections in formation different from that of a column, as Commander Vannutelli has proposed in the article already cited. "In column of vessels and with high speed, it is easy to lose contact, or, *vice versa*, to have dangerous closings in, especially when navigating with lights obscured; that is to say, when about a hundred meters of distance is enough for losing sight of the stern of the preceding torpedo-boat, while in lines abreast or oblique lines it is much more difficult to lose sight of the dark lines of the entire length of the adjacent torpedo-boat. Every one will remember the intense watchfulness and the continual variations of speed that the column of vessels requires by night, which, therefore, in a short time brings great fatigue. With frontal orders the squadron is presented well subdivided into two tactical groups, ready to separate for the opportune maneuver."

72. *Scouting.*—As is well known, we mean by *tactical exploration* that which is exercised by ships in direct communication with the main body, remaining in contact with it at a distance such as to permit a discreet reliance on being able to regain it when it passes to tactical contact with the enemy's battle forces. It is well for this reliance upon the reunion with the main body to be so much the greater, the greater is the tactical importance of the ships employed; that is to say, the greater the importance of these ships, the shorter should be their distance from the main body. Only in exceptional cases could it be desirable for the battleships to sight directly those of the enemy; thus, when in the Chino-Japanese War, Admiral Ito moved in search of the fleet of Ting at the mouth of the Yalu, he was not preceded by any ship, because he aimed at surprising the enemy. But he was able to rely upon the inertness of the Chinese; in general, however, it is presumable that the enemy will maintain a scouting service, especially if he is occupied in operations owing to which he might, by our unexpected arrival, be placed in a critical position; and then comes the necessity of being preceded by ships that will seek to repulse the enemy's cruisers, preventing them from establishing contact with our main body; that is to say, from comprehending the importance of the danger that menaces their fleet.

The importance of knowing beforehand of the approach of the enemy's fleet really exists, as we shall endeavor to show; but it is well to consider in what degree we may be able to satisfy it, if it cannot be presumed in what direction the enemy will be sighted. If we should pretend to form with the tactical scouts a continuous line about the main body, either we should have to employ many units, or the radius of the explored zone would be greatly restricted.

It results from this that tactical exploration, like strategic exploration, must have for its object the search for the main body of the enemy's forces, having regard, however, to certain limits of distance from one's own body. To the end that the warning may not be illusory, it is well to abandon the certainty that the scouts will encounter the enemy before the main body does so, and be content with only a probability. A lookout service tending to establish almost absolute safety over a sufficiently wide sector about the main body is, however, required *when the presence of numerous torpedo-boats can be expected in the sheet of water to be traversed.* In such service the vessels destined for tactical scouting assist; they constitute a first line of defense which, for the reasons mentioned, cannot be entirely relied upon; it is necessary, however, to guard oneself effectively, which can be done in the following manner, on the basis of the deductions of the preceding chapter:

Remembering that the torpedo-boats sighted astern are the least dangerous, it is necessary, by night, to have the naval force preceded and flanked by groups of torpedo-boats at a distance from the main body such that the searchlight of the ships may be operated upon occasion without illuminating them. Each section of torpedo-boats must cruise in compact formation in order to be ready to attack the enemy's forces that it may encounter. The greater cruising speed may be utilized by making these groups traverse a zig-zag with sides suitably inclined to the course of the main body. These torpedo-boats must signal the approach of those of the enemy and try to drive them back, without coming within range of the light guns of their own ships, since every ship must necessarily be able to fire upon any torpedo-boat that approaches it.

In order to exercise vigilance by day against submersibles, it is necessary for the destroyers to keep a lookout ahead and on each

side (up to about 45° from the course) extending themselves in chain. It would be desirable to have a chain at three miles and one at five miles; that is to say, within the limits at which the submersibles must begin the maneuver of approach.

73. *The Reconnoitering of the Adversaries.*—Although it may not be excluded, it is nevertheless not very probable that the fighting forces will sight each other directly; indeed, even admitting that only one of the hostile fleets carries out tactical scouting, when its scouts arrive in sight of the enemy, the latter will detach ships to drive them away, in order to prevent their maintaining the contact; and, as in the case wherein the scouting is carried on by both the adversaries, *an action between cruisers will precede the battle.*

It might be said that this statement is contrary to experience; the encounter between cruisers has not yet been produced, notwithstanding three successive wars; but we can easily give reasons why this may have been the case. For the Chino-Japanese War the consideration already advanced will serve; for the Hispano-American War, the battle took place between a division of four ships and a squadron that was blockading it, keeping with all its ships in close proximity to the entrance of the port. Finally, for the Russo-Japanese War, it is well known that the Japanese main body was constantly preceded by the cruisers; the battle of Tsushima would have begun as above stated if Rojestvensky had had the means of fighting the enemy's cruisers. But, as Semenoff observes in *Rassplata,* the Russian cruisers were either too weak or very old and with insufficient speed. "Furthermore, the admiral desired to save and keep all the elements together; the more so, since, the 12 armored ships being engaged with the 12 Japanese armored vessels, the cruisers would have had to protect the transports and engage by themselves all the rest of the Japanese fleet."

When the encounter between cruisers takes place, the party that has the greater strength in ships of this class, by obliging the enemy's cruisers to turn back, obtains the singular advantage of being able to regulate its own maneuvers of approach on the basis of information transmitted to it; while the enemy remains in uncertainty. In this way there is produced the situation that beyond dispute was realized at the beginning of the battle of Tsushima. Togo, after having stated that his cruisers reconnoitered the enemy without difficulty, adds the following: "These

divisions, although cannonaded from time to time by the enemy, succeeded in preserving the contact, sending by telegraph frequent and precise news concerning his position. And thus, notwithstanding a thick fog that did not permit of seeing further than five miles, we were able to know the position of the enemy, although he was 30 or 40 miles away, as exactly as if we had seen him with our own eyes. . . . . It was thus possible for me to make the dispositions for finding myself at about 2 o'clock near Okinoshima and to attack the head of the column on the port side."

The development of an action of growing importance between the cruisers will induce the main body to detach a sufficient force to complete the *reconnoissance*. In order to fix in our minds how this may happen, let us make use of an example.

A scout has sighted a ship; it moves to observe it and informs the nearest friendly ships of it by wireless telegraph, which ships transmit the news to the commander-in-chief. The suspected ship also has headed toward our scout, so that the recognition is quickly accomplished; the vessel sighted is a protected cruiser of the enemy, weaker than our own, and, consequently, at a distance of not less than 7000 meters it turns to run. The commander-in-chief does not consider this of sufficient importance to alter the course of the main body. The chase of the cruiser continues for some time and our ship gains upon the enemy, so that there is hope of making a good stroke.

A few ineffectual shots have already been exchanged by the two ships, when suspected ships appear upon the horizon, and very soon they are seen to be enemies. It is now the turn of our cruiser to run. It is is well to mention that when our cruiser was increasing its distance from the main body, another ship was moving so as to maintain a chain with it for the transmission of news. When the new enemy's ships are reported, there is then on our part a concentration of a division of protected cruisers in the direction of the adversary; thus we have again a preponderating force and the enemy again turns to run. The course of the main body is somewhat inclined in that direction and the appearance of new ships on the horizon decides us to effect a reconnoissance; that is, to determine if there are other principal forces of the enemy at hand besides those sighted. For this purpose it is determined to send out toward the adversary forces that will not be obliged to

give way except before the enemy's main body; in other words, the armored cruisers are sent forward at that time, at full speed, and the battleships follow ready to support them. The appearance on the horizon of a new division of the enemy still further confirms the idea that important forces are to be found in that direction, and, indeed, in the new division, we recognize the enemy's armored cruisers. The inferiority of the enemy in ships of this type is not slow in producing its effect; the adversary, in order not to be beaten in detail, must turn back and seek the protection of his battleships, that are sighted a little afterward. The object of the reconnoissance is attained; our ships take up a course parallel to that of the enemy and at his speed, signalling to the commander-in-chief the composition and the formation of the enemy's force; our admiral is thus in condition to make the necessary arrangements for attacking the enemy in the most opportune way, or to reverse the course if he does not wish to accept battle. Then begins the contact out of range.

CHAPTER II.

The Battle.

74. *The Importance and Character of Naval Battle.*—As Makaroff writes, "the loss of ten ships in as many combats has not the moral effect of the loss of a squadron, although the number of ships lost may not reach ten."

The destruction of the enemy's movable forces constitutes the essential object at which we must constantly aim; pretending to secure the object of the war by avoiding battle between the forces and seeking secondary objectives is shown by history and deductive reasoning to be entirely erroneous; to us Italians it brought forth Lissa. *A battle desired is greatly preferable to a battle submitted to.*

These axioms, that should be taken as the basis for the strategic employment of the fleet, impose engaging tactically with the enemy's movable forces whenever possible, and, conformably to what we set forth in section 23, they impose engaging to a finish as far as the strategic situation permits.

A characteristic of naval battle is, that in it the constitution of a *reserve* cannot be admitted in the sense that it is understood on land. This difference is easily explained.

On land, when the battle begins, the strength of the enemy is not exactly known; it is not known where his principal mass gravitates; and in order to be in condition to face the situation at the moment it becomes clear, it is necessary to keep available a force to be hurled in an advantageous direction. Moreover, the idea of the gradual employment of the forces is logical, it being that of having troops that serve to support others already engaged, because the latter, besides the losses that they sustain, use up their energy; and hence it is in a high degree important to be able to dispose of fresh troops at the opportune moment, to be despatched in aid of the others.

It is, however, useful for our purpose to remember that even on land it would be dangerous to give too much importance to the criteria just mentioned. "Every reserve," writes Von der Goltz *(La Nazione armata)*, "represents a dead force. Since the simultaneous employment of all the forces brings out the maximum efficiency, it would generally seem erroneous to constitute

reserves; but there is need of them in order to be able to meet unexpected incidents and sudden turns in the combat that are never lacking. If the situation is still more uncertain, if it is believed, for instance, that we may be exposed to many surprises, then strong reserves will be necessary. *The safer the situation,* and the better able we are to estimate concerning the enemy, the weaker the reserves may be. *We can even imagine a circumstance in which it would be logical to proscribe them; that is, when the enemy is completely displayed.* Now, such circumstances will certainly never be realized in practice, and, therefore, we ought never to fight without reserves. It is certain, however, that the opportune reserves are not always the heavy ones, but those that respond to the situation in which we find ourselves."

In the galley period, owing to the fact that a part of the vessels could sometimes be concealed, that the motive power was muscular, and that men fought hand to hand, there were presented conditions analogous to those of battle on land. But to-day the situation is far different; in naval battle we find ourselves in the ideal conditions in which, as Von der Goltz observes, reserves could be excluded even on land.

It might seem advisable to constitute a reserve formed of antiquated ships with scant protection, keeping them on the side of the alignment away from the enemy, and far removed from him so as to safeguard them. Their mission would be to attack injured ships of the enemy that might attempt to withdraw from the combat. But, ideas of this nature, if they were adopted, might bring about a repetition of the conduct of Albini's squadron on the unfortunate day of Lissa; let us remember that it was then said and repeated that wooden ships could not engage with hostile armored vessels. It would be better to leave the antiquated ships in port, or have them previously stricken from the list, rather than take them out before the enemy for the sole purpose of *safeguarding* them and confiding to them an illusory objective.

When it is deemed advisable to take into battle a few antiquated ships, because the offense of which they are capable is not to be despised, and because their speed is sufficient not to lessen the maneuvering qualities of the fleet, it is indispensable that they take a direct part in the battle, and only compatibly with this may they be safeguarded.

More generally, it is well to exclude the idea that while one part

of the ships is fighting, another part may remain in waiting; in such fashion we should offer to the enemy the means of beating our forces in detail; and a disastrous moral effect would be produced in the ships of the reserve. Indeed, let us figure to ourselves what was the state of mind of the personnel of the Russian cruisers at the battle of August 10, 1904, when, after the injuries sustained by the *Askold*, they were placed behind the armored ships.

The supreme importance of the battle demands that all the ships that have the gun for a principal weapon, shall fight from the start, assigning, however, to the various kinds of ships an adequate objective.

It is well known that Nelson, in the memorandum for Trafalgar, alluded to composing a division of the fastest sailers of the fleet, reserving it to himself to indicate, according to circumstances, to which of the two divisions it should join itself; with the intention, however, that the said division should participate in the battle without delay.

The vessels to be kept in waiting are limited to the destroyers and the torpedo-boats. It is not excluded that this light flotilla may render some service (section 69) in the phase of tactical evolutions; during the fleet action it will be kept in opportunely selected coast positions when the battle is developed in proximity to a friendly shore, otherwise they will be kept under the protection of the ships, or at a convenient distance, according to the employment that is had in view for them.

In determining the mission to be assigned to the various kinds of ships, *it must be borne in mind that the issue of the battle depends upon the combat between the armored fleets.* It would, therefore, be absurd initially to withdraw from such category any ship that has protection sufficient for taking part in the principal combat without excessive risk, or that, although having inferior protection (antiquated ships), has a powerful armament; in the latter case it will be placed in the outer line but close to the other ships so as to be able to fire in their intervals.

A few light ships will be necessary out of the line, on the side away from the enemy, in order to repeat signals; it may be advisable to have a repeating ship for every six ships of the line of battle. The other unarmored ships, formed into a fleet independent of the principal one, will have the task of engaging with similar ships of the enemy; so that it is to be presumed that, as at

Tsushima, there will take place a *secondary combat* simultaneously with the principal one.

75. *Contact out of Range.*—The party whose cruisers have established contact with the enemy's main body, according to what is said in the preceding chapter, prepares for battle on the basis of their information; or it alters the cruising formation as may be necessary, and steers so as to sight the enemy from an advantageous position.

If the conditions of visibility were limited, so that the distance of sighting the enemy were within the limit of offensive contact, the advantage in this way would be very great. Nevertheless, under good conditions of visibility the enemy will generally have time to assume an equivalent alignment. The evolutionary phase will then begin.

In Chapter III, of Part II, we endeavored to make it plain that it may be presumed that a phase of active maneuvering will take place out of range, with the object of securing an initial advantageous position. In contrast with the arguments therein adduced there could be cited a phrase of Nelson: "Between two fleets that desire to come to battle, the necessary maneuvers will be few; it will be desirable to make as few of them as possible."

Let us observe that Nelson was referring to the fleet of Villeneuve, which, it was to be presumed, would maintain a passive line of conduct, and that, naturally, he was not neglecting to prescribe the maneuver of approach so as to secure an advantageous position. Under analogous conditions, there is no doubt that the simpler and more rapid the maneuver of approach, the better it will be. Maneuvers out of range are a means of beginning the battle well, and they do not constitute a finality; hence they are absurd if they are not necessary. But if the enemy maneuvers so as to dispute with us the advantageous position which Nelson was not hindered from taking, it will be necessary for us to maneuver also, or resign ourselves to performing the part of Villeneuve.

76. *Offensive Contact.*—After the signal has been made at the beginning of offensive contact to indicate the guiding principle of the maneuver, other signals cannot be absolutely excluded, because it would be absurd for an admiral to renounce expressing his ideas when it is possible and necessary; hence it is natural that there should be battle signals, provided that they are simple and limited in number, and can easily be memorized.

If the commander-in-chief is on a ship in line with the others, he is exposed to great dangers, it being presumable that the said ship will be the principal object for the concentration of fire. But it would certainly not be logical to revert, for that reason, to the solution adopted by the French after De Grasse was made prisoner at the battle of the Saintes, that is, to the system of placing the commander-in-chief on a light ship out of the line—a system they were obliged to abandon.

Tactical maneuvers must, as we know, be based essentially upon the following of movements; so, then, if the commander-in-chief were out of the line, it would be necessary to depend exclusively upon his signals.

To the end that the commander-in-chief may have a well-grounded hope of exercising his directive functions, it is necessary for him to have a means analogous to that which is available on land by means of the reserve; that is, it is necessary for him to have a division under his immediate orders.

Now, we bear in mind that, in tactical maneuvering, the regulating ships of all the divisions are those at the extremities; in order to render minimum the necessity for signals, it is then necessary that there be an admiral at the extremities of the formation of each division. In order that the inconveniences may be minimum in case the commander-in-chief is disabled, it is necessary in such circumstances for his division to continue to be the regulator; that is to say, it is well for the second admiral of the division under the direct orders of the commander-in-chief to be the second in command of the fleet.

It might be held desirable, still satisfying the above-mentioned condition, that, in a line formed, for example, of 12 ships in two divisions of six ships each, the second in command be at an extremity and the commander-in-chief in the center; but we believe he would repent having yielded the position of honor, as Farragut repented it at Mobile.

Having to fight a fleet more powerful than our own, it might seem desirable to seek battle under the forts, in order to find in their support a compensation for our own inferiority. But this would dangerously hamper the strategic employment of the fleet, as well as its tactical employment; and these hindrances might carry with them such detriment as to overbalance the gain in offensive power constituted by the action of the forts.

The issue of offensive contact will not depend upon maneuvering and ability in firing alone, but moral factors will have great part in it.

We can never be sufficiently imbued with the fact—examples of which are not lacking in history—that often one is beaten solely because he is persuaded that he is beaten. Daveluy justly affirms that he who engages in battle with the firm determination of not yielding, is already half a conqueror. On the contrary, he who goes into battle believing that he is accomplishing a useless sacrifice, will hardly succeed in finding energy to give rational direction to the conduct of the forces. Defeat in that case will not be glorious, since, although the situation may be most desperate, there always exists a rational plan to be adopted.

Battle serves to create between combatants differences in order, in material and in morale; in the pursuit we may gather the fruits of such differences and accentuate them in much greater proportion.

The separation of the forces for the pursuit depends upon the separation of the enemy's forces. When, during the night that follows the battle, contact with the enemy is lost, owing to the necessity of leaving a clear field for the action of the torpedo-boats, it will be endeavored, on the following morning, to re-establish the contact, profiting by our conditions of superiority so far as to abandon, at least in part, those precautions that would be indispensable against an enemy in full efficiency. Even the battleships may then be extended in chain for the search.

77. *Tactical Exercises.*—The tactical skilfulness of a fleet can be obtained only through *frequent exercises with parties opposing each other.* As a preparation for these exercises at sea, the tactical game may be profitable; nevertheless, the profitable return of this game is somewhat limited for various reasons, among which are the impossibility of reproducing in them the steering by sight vane, and, more generally, the impossibility of regulating oneself by the enemy in a continuous manner.

To the end that the tactical exercises may be conclusive, it is indispensable that those who are called upon to execute them should possess a sufficient substratum of theoretical knowledge.

THE END.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON AVIATION.

By CAPTAIN W. I. CHAMBERS, U. S. Navy.

SAFETY IN FLIGHT.*

The principal factors upon which safety in aeroplane flight depends may be found in three broad groups. (1) Reliable and efficient motive power. (2) Good architecture and careful workmanship. (3) Good airmanship or skillful management.

To my mind, the first two factors may be regarded as sufficiently advanced to insure safety now, although they require further advancement to assure the desired degrees of success. But, as with automobiles, there is a limit to the degree of speed that can be controlled so as to insure the desired degree of safety. The discovery of this limit and the keeping of it within the bounds of safety depends absolutely upon the skill of the airman.

Many aviators are flying without the use of speed indicators, or any other efficient scientific instruments, to warn them when they are in danger and it is probable that many skillful airmen who now depend entirely upon the senses of hearing and touch to warn them of danger, would be able to fly in safety during weather that they are now too prudent to fly in, if it were common practice to use practical and dependable navigating instruments to guide them.

I can readily understand the prejudice that exists among experienced airmen to the use of automatic stabilizers, especially if such devices require adding a considerable weight to the machine. They realize that mechanism is apt to get out of order or to fail at a critical moment and that, at such times, the real bird instinct is necessary to secure safety.

It is apparent from French efforts that their leaders in aviation are seeking to improve safety in flight by an extensive use of scientific instruments to guide or to assist them, and I quote freely

* Portions of this article have previously appeared in *Aeronautics* and the *Aero Club Bulletin.*

some French articles for the purpose of disseminating a more extensive knowledge in this country of two notable French efforts in the direction of safety and of presenting the question of good airmanship in a clear and profitable manner.

To my mind these articles serve to show that the use of such instruments makes for precision in aerial navigation, avoids the folly of haphazard flight and tends to educate the airman in the instincts of the bird.

Bearing in mind the desire to obtain illumination for night use and to embody adjustable electric terminals, for automatic stabilizing, I have in mind a compact design to embody all of these advantages. This design is not complete but, as I have hastily prepared it, will soon be published for comment and criticism. I hope it will stimulate others in this important field to experiment with such a device at the earliest opportunity.

There are two important limits to the speed of an aeroplane, (1) a high speed which it is not prudent to exceed for fear of rupturing the planes, and (2) a low speed, below which the control system will not work to restore equilibrium.

A prudent pilot will always aim to maintain the speed between these two *critical limits* and will keep away from each extreme sufficiently to avoid being thrown beyond either in times of unexpected danger. When the air is disturbed and wind variable, the aerial billows alternately oppose or follow the machine or strike it at varying angles, under which circumstances the limits of critical speed approach each other. In other words, the range through which the speed may safely vary diminishes as the waves increase either in violence or excentricity.

During a flight, with the motor running in a normal way, to each increment of speed there corresponds a certain angle of inclination which is the most efficient for that speed, but it is certain that no danger is risked when the speed oscillates in a sector of which the extreme sides correspond to the critical speeds. The angle or gap of this sector is usually ample and when the air is calm it is easy to keep the speed of the aeroplane within the sector of safety. But when the air is disturbed, the flight becomes more difficult as the amplitude of the sector diminishes.

Also, when the motor power suddenly varies, the angle of the sector diminishes proportionately. The pilot must then execute

a quick maneuver to bring the speed within the more restricted sector of safety; he must be quick to act in case of weakness of the motor and incline the aeroplane to the angle which appears best to maintain equilibrium. Experienced aviators readily feel the position of the machine's equilibrium, but inexperienced aviators are apt to risk their lives in forcing an ascent at starting, or even during a flight, with a motor which works badly. Also, in checking the descent, during a *vol plane*, they sometimes lose their speed and capsize or drop.

The speed indicator was designed to afford a clear ocular view of the variations in speed and to enable the pilot, in a systematic manner, to maintain the speed always within the sector of safety and under the best control to suit the various conditions that are met in flight.

A Speed Indicator and Flexible Automatic Controller.—The instrument is designed for mounting to the right of the pilot. Fig. 1 is a view of the left side. Fig. 1*a* is a view of the rear end. Fig. 2 is a vertical longitudinal section through the rod *G*. Fig. 2*a* is a vertical cross-section through the rod *G* and shows the box to be divided into two compartments, *A* containing the pressure regulators and *B* containing the control regulators. Fig. 3 shows the left side open (the left covering plate being removed) exposing the control regulators, or critical limit arms, *sl* and *fl*. Fig. 4 is a view of the top.

The rod *G*, carrying the adjustable pressure sphere *S*, penetrates compartment *A* to the axis *O*, to which it is rigidly attached. The left end of *O* carries the pointer *H*, the right end of which is shown in Figs. 1 and 1*a* just above the reference mark *R*.

The pressure regulators (Figs. 2 and 2*a*) comprise the spring *M*, the tension of which is adjusted by the nut *N*, and the balancing weights *K*. These weights are connected with the rod *G*, above the axis *O*, by the flat springs *s*, at the crosshead *a*, which is adjustable on the rod *G*. The springs *s* are also adjustable on the arm *a* and the weights *K* are adjustable on their stems. The variety of adjustments, (1) the sphere *S*, (2) the spring *M*, (3) the arm *a*, (4) the springs *s*, and (5) the weight *K*, provides ample flexibility for the power and the sensitiveness of the pressure sphere and for the power and sensitiveness of the accelerating action of *K*, which operates above the axis *O* and in accord with the principles of the Doutre Stabilizer.

A Speed Indicator
combined with
Automatic Control

BY
Captain W. Irving Chambers
U.S.N.

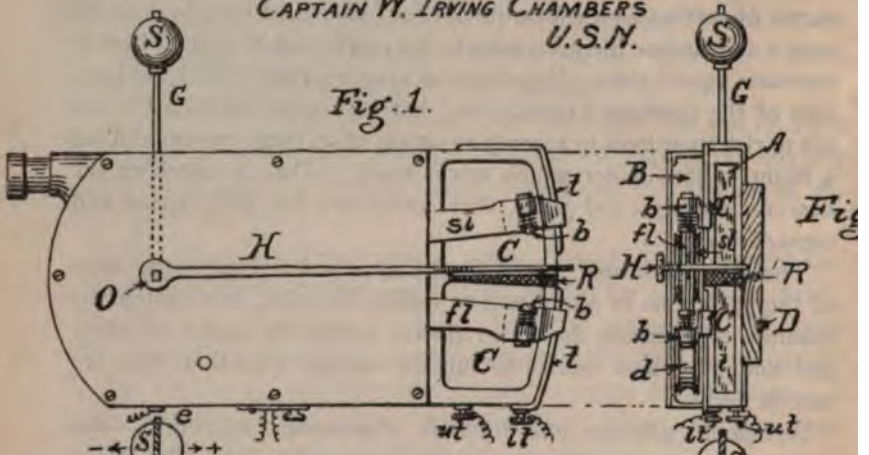


Fig. 1.

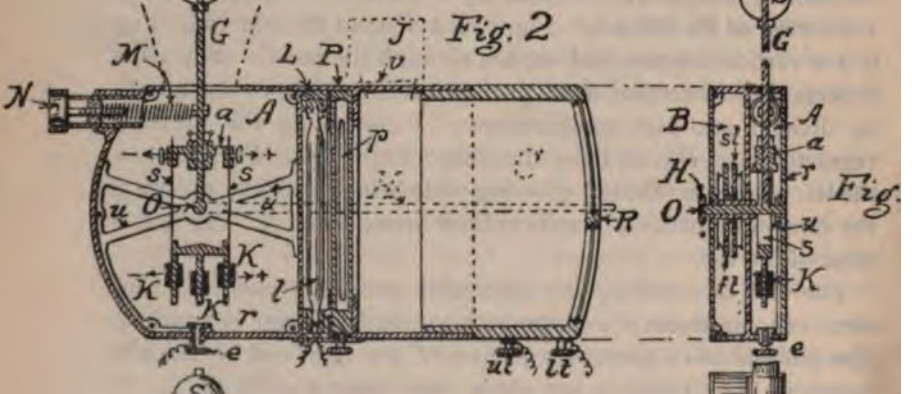


Fig. 2

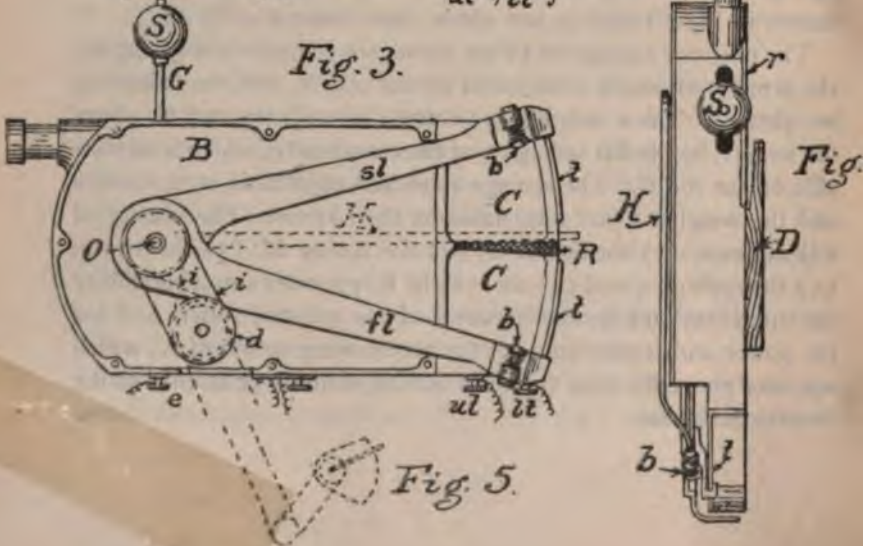


Fig. 3.

Fig. 5.

The right side of the instrument carries a covering plate *r* which may be removed to make the adjustments, the brace *u* providing a support for the right end of the axle *O* and also providing direct electric connection between the pointer *H* and the binding post *e*.

An electric light *l* is introduced into the sub-compartment *L* and a rotatable cylinder *p* occupies the adjoining sub-compartment *P*, the bulkhead between them being provided with a slot for the escape of light; *p* is also provided with two slots and the admission of light to the dial sector *C* may be made as bright or as dim as desired by rotating *p*.

In Figures 1 and 3 the critical limit arms *sl* and *fl* are seen, at different angles of separation, extending across the face of the transpartent windows of the dial sector *C*. These arms are made of non-conducting material, such as ebonite, and the rear portion of compartment *B* (that containing the dial sector *C*, see Fig. 3) is also of the same material. The critical limit arms rotate on a sleeve (Fig. 2*a*) which is part of the bulkhead separating compartments *A* and *B*, and the axle *O* rotates, independently, inside of this sleeve.

The rear ends of the arms *sl* and *fl* are provided with metal tips which are grooved and brushed to fit over the metal guide rods *tt* which form separate electric conductors to the binding posts *ut* and *lt*. These metal tips are also provided with spring buffers *b* either one of which, by contact with the metal pointer *H*, as it moves up and down, energizes one or the other of two oppositely rotating magnets (as in the Ellsworth stabilizer), thus rotating the armature and the drum, upon which is wound the elevator wires, and thus moving the elevator either up or down. Contact of *H* with the upper buffer *b* moves the elevator for descent and in the same manner contact with the lower buffer causes ascent. That portion of *H* which passes beyond the point of contact and around the rear windows of *C* is also made of non-conducting material.

If the arms *sl* and *fl* are widely separated, as in Fig. 3, the mechanism provides a wide range for semi-automatic control, the drum upon which the elevator wires are wound may be freely worked by the control lever when the electro-magnets are not energized by the contact at *b*. If *sl* and *fl* be brought near to the reference mark *R*, full automatic control is provided and it is a simple matter to arrange a separate switch, near the pilot, by which the magnets may be rendered inoperative, if desired.

The pilot may quickly adjust the critical limit arms, to suit any conditions, while in flight. By moving a small lever on a dumb sector, such as shown in miniature, Fig. 5, by means of which the drum *d* (Figs. 3 and 1*a*) is revolved, and by suitable belts *ii* operating corresponding drums attached to the arms *sl* and *fl*, these arms may be moved as desired.

A mounting board *D* (Figs. 4 and 1*a*), adaptable for shaping to any specific location of the instrument, is attached to the right side of compartment *A*.

A 2-inch barometer (or a larger one if desired) with a conspicuous pointer may be neatly mounted above compartment *A*, as indicated by dotted lines at *J*, Fig. 2, receiving its light through a slit, as at *v*, the light being reflected to the barometer dial from a small semicircular reflector, above its face, secured to the housing box.

Thus we combine a flexible automatic stabilizing device, of light weight and sound principles, with an effective speed indicator which is always adjustable to suit the conditions of flight and is always available for use in event of motor derangement. Reserve tanks and batteries to work the stabilizer in case of motor derangement are, therefore, superfluous with this device.

The variable speed friction control would work well with this device and the generating power for operating the wireless is sufficient to work the stabilizer as well as the self-starter, the speed indicator always remaining as the main reliance when the automatic power is cut out.

Now that the French have secured an enormous sum for additions to their aerial army, some anxiety is being manifested in the public press as to the fitness of their machines, notably in *L'Eclair*, *L'Aurore* and *Le Figaro*, and attention is being focussed upon means for securing *safety in flight*.

To my mind there is no need for apprehension, although I have long felt that in matters of such importance false moves should be avoided, as far as possible. I am convinced that reasonable safety in flight can be assured in the best American machines, by the general use of certain mechanical agencies which are already on the market, and that the inherent stability of aeroplane as well as the reliability of motors will steadily improve.

Nevertheless, it is evident that apprehension is felt in France, in quarters where least expected, and, although it is also evident

that those who are directing affairs and who are best informed are doing the correct thing, there is danger that a panicky feeling may result in a serious blow to the art of aviation during its most critical phase.

As an example of the sentiment in some quarters the following quotations are extracted from a contribution by "X" to *La Technique Aeronautique*, April 15, 1912:

Lately the public demand, as voiced by debates in Parliament, was for an annual sum of not less than 75 millions (francs) or enough to acquire a fleet of 1000 aeroplanes.

Inspired by the efforts of Germany, is was said, France cannot go slow without danger of losing a supremacy dearly acquired. We believe that there is in this manifestation many illusions which are dangerous to manufacturers as well as to aviation.

We have seen that Germany is conservative in devoting a more modest, but still a considerable sum to the creation of an aerial fleet. They surely understand the military value of aeroplanes as engines of reconnaissance, but they also recognize that to pilot 1000 aeroplanes 1000 aviators are necessary. We now possess no more than a hundred, civil and military, capable of rendering the practical services demanded of them in time of war. As for the Germans they regard aviation with a cold and positive enthusiasm and they know very well the hour has arrived to show their confidence in those who are qualified to make the conquest of the air a reality.

Now, in France, we are beginning to show that we no longer believe that the conquest of the air is an accomplished fact, because each week increases the number of mourners over the martyrs to aviation. If we are not careful it will be aviation itself for which we will be in mourning.

Civil opinion is indicated by the fact that the number of aeroplanes purchased for public use is gradually decreasing. If the public becomes *blasé* in the matter, as it is very near to being now, public sentiment will close the purse and condemn aviation *en bloc*. It is ominous that manufacturers no longer wish to race, notwithstanding the large prizes offered. For the want of something convincing, all that concerns aviation is under suspicion.

The reflections of the public run something like this:

What change has come over the machines since Bleriot crossed the channel?

The effective performances are due to the pilots not to the machines. They are obtained at the cost of a veritable squandering of motive power, of money and of human life.

The exhibitions (*salons*) follow one another, but they are all alike.

When a pilot has made a fortune he gives up his place to others. What a singular symptom! Certain constructors who were revealed as marvelous pilots and who had their triumphal march in the *debut* of aviation, no longer pilot their machines in the great trials.

One hesitates long before writing about things of fear and of injury to

the grand cause of aviation, but it should do no harm to discuss these matters, for everyone knows the blue side of the facts and it will not do to ignore what has already gained public notoriety.

It was announced in advance that *great revelations* would be made at the last military competitions. Everyone knows that the great revelations did not materialize. Why was no greater improvement shown? Is the industry dead or is it true that further progress is impossible? Public opinion hesitates between these two questions.

The great improvement that is demanded is safety.

To affirm that accidents are due to the blunders of pilots, to wind eddies, to "holes" in the air, is no solution. That is only shirking responsibility and there is attached to it a serious flareback.

To put it mildly we cannot take liberties with the good sense of the public. The public does not wish to become an acrobat to avoid being killed in an aeroplane and it is now time to design the machines to "master wind eddies and 'holes' in the air."

All of this seems hysterical, but it is valuable as a sign-post showing which road to take and which to avoid.

The same journal states editorially:

Current opinion, very characteristic and very emphatic, pronounces more and more in favor of researches having for their object the safety of aviators.

The *Union for Safety* comprises representatives of all the societies, happily very numerous, which are interested in the future of aerial navigation, such as the Aero Club of France, the General Aeronautical Association, the Syndicated Chamber of Aeronautical Industries, the Automobile Club of France, the National Aerial League, the French Society of Aerial Navigation, the Touring Club of France, etc.

The delegation of this Union, having at its head M. de la Vaulx, was lately received by the Minister of Marine, who assured its members of his co-operation and who promised to take up without delay, with the Ministers of War and Public Works, the consideration of the best measures for the expenditure of a sum of 500,000 francs donated to reward inventors and constructors who could assure the safety of flying machines in an efficacious manner.

This is an eminently useful work and of the greatest urgency. We should not, however, count on the immediate production of perfect machines.

As soon as a means for diminishing the chances of accidents has been found it should be immediately applied to our avions. Public interest is excited in favor of all aviators but those for whom aviation has become a military duty are entitled to special consideration.

The Presidents of the syndicates for War material and Naval Construction, and the Committee of Iron Industries and Railroad Material have placed at the disposal of the Ministers of War and Marine the sum of 150,000 francs, subscribed by their patrons, to be applied to naval and military aviation. In response to the intentions of the subscribers this sum is

donated to the Government with full discretion for employing it in solving the problem of *safety* in aerial navigation.

To my mind the sums above mentioned should be credited to M. Eiffel, M. Doutre and Captain Etévé.

The following comments on the fact that Prince Henry of Prussia had opened up an aviation subscription list similar to that lately completed in France appear in the same journal:

The German tendencies are very instructive and we should watch them very closely. . . . The most important things recognized are, above all, the *quality* and the *safety* of the machines much more than the *number* and *quantity*.

In the same number of this publication appears an article by one of the pioneers of aeronautics, Commandant Paul Renard. I hope that this article will do something towards hastening the more general use, in this country, of mechanical aids for safety in flight.

The safety of aviators rightly concerns all who are interested in aerial navigation. The frequency and the gravity of accidents, independently of humanitarian considerations, is deplorable from the point of view of aeronautical progress and requires us to seek the means, wherever to be found, for avoiding or for limiting the consequences.

One of the most troublesome causes of catastrophy is that of instability of aeroplanes. An aviator takes flight, he rises without difficulty, travels over the atmosphere at great speed; all seems going well when, suddenly, the machine rears, or plunges by the head, or it tips over on one side, then quickly falls to earth crushed with its human freight.

What are the causes of these mysterious accidents? They are wind gusts, "holes in the air," it is said. Almost always the caprices of the atmosphere are accused, sometimes it is the strength of the apparatus and sometimes false maneuvers are blamed.

How can we discover the cause? Those who investigate find on the earth only a mass of wood, cloth and steel wires mixed up with fragments of motor and propeller. In the midst of this chaos is the victim. All the explanations given are extremely inaccurate, but that which is certain is that it happened, in the midst of most satisfactory flights, from *unforeseen* circumstances which compromised the stability of the apparatus either in a longitudinal or in a transverse direction.

All technicians agree in saying that an ideal aeroplane should, when its equilibrium is disturbed, in one direction or the other, re-establish its balance automatically. Most of the existing aeroplanes possess this property to a certain degree, but the re-establishment of equilibrium requires a certain *time* during which the aeroplane almost always approaches the earth. If it is not sufficiently high up, it strikes before being able to recover the normal position. This is already one cause of frequent accidents, but there are others.

The stability of existing aeroplanes is generally limited, *i. e.*, they recover their normal positions only on condition that they do not pass a certain inclination. Furthermore, they are "compromised," that is to say, they have passed their zone of stability and instead of returning to their normal positions they incline more and more. The *chute* and the unexplained death follows.

A skillful pilot can immediately combat ruptures of equilibrium by convenient maneuvers. If they are always made in time, he is certain not to pass the limits of stability and will avoid the compromising position.

Unfortunately, it requires great skill always to maneuver opportunely and with the necessary rapidity, even the best of pilots may tire and grow careless. At other times the disturbing causes may be unexpected or manifested in a manner or at a time when the pilot is already too late to combat them.

Several persons have endeavored to ameliorate this situation by providing the pilot with mechanical agencies for his guidance. Some, like Captain Etévé, recommend the use of indicators which inform the pilot of the modifications in the behavior of the apparatus which he could not otherwise perceive soon enough and notably as to the changes in speed with respect to the surrounding air. Thus warned, the pilot can execute, in proper time, the maneuvers that without the instrument he would have performed, perhaps, too tardily.

M. Doutre goes further, his apparatus does not indicate the maneuvers which must be done, it executes them. His apparatus is a real automatic stabilizer.

The inventor has concerned himself, so far, with longitudinal stability only, but it is understood that he expects ultimately to master the problem of lateral stability.

His apparatus moves the elevator and modifies the longitudinal inclination of the aeroplane automatically. These movements are controlled by two distinct and separate organs, an accelerator and anemometer.

The accelerator acts in obedience to the *absolute* variations in the speed of the machine. When, from whatever cause, the forces which drive the machine forward are augmented, the speed tends to increase, but, by virtue of its inertia, the center of gravity of the machine does not obey, instantly, the increase in force and there results, according to the conditions of the increase, inclinations either up or down which may become dangerous.

M. Doutre combats them in a convenient way by maneuvering the elevator, which maneuver is controlled by the displacement of the accelerator, the position of which, with respect to the aeroplane, is influenced by the accelerations, positive or negative, and which move the elevator through the medium of the valve on a servo-motor operated by compressed air.

In the other case it is not the absolute speed which changes, but the *apparent* speed or the *relative* speed with respect to the surrounding air. If this speed increases no great inconvenience is caused. The trajectory rises more or less by reason of the increase in the sustaining force and, at the end of a certain time, conditions are established which do not give serious concern.

It is not the same, however, if the apparent speed diminishes. Then the sustaining power becomes insufficient and the machine seeks the earth, but at the same time its longitudinal equilibrium is compromised. It is necessary, at all hazard, to render the relative or apparent speed normal, and, to this end, to have recourse to an auxiliary motor which is always ready to speed up and which is no other than the *weight of the machine*. In other words, it is necessary to incline the machine in such a manner that it will follow a descending trajectory at such a slope that the action of the weight combined with that of the motor, which alone would be insufficient, restores the normal speed.

For this purpose the Doutre stabilizer carries a plate of *palette* perpendicular to the axis of the aeroplane which constitutes an anemometer measuring the relative speed. When that speed exceeds the normal the *palatte* is immobilized, but in the contrary case it is displaced under the combined action of the springs and the air resistance and, by its displacement, moves the elevator so as to cause a descent and thus increases the speed.

If the accelerator and the anemometer work in consonance their combined effect in moving the elevator, is to increase the movement. If, on the contrary, their respective impulses are contrary their combined effect is to decrease the movement.

The conception of such an apparatus is eminently rational, but it is important to remember that M. Doutre has no thought of presenting his stabilizer as a universal *panacea* for assuring the longitudinal stability of a machine that is deficient in stability. No, the inventor expects the aeroplane to be as stable as possible, but as the ordinary stabilizing influences act slowly, if they are always relied on occasions will occur when the equilibrium will be re-established too late. It is necessary to anticipate the perturbations and to execute quickly the maneuver required to return to the normal position.

All the slow perturbations will be corrected by the disposition of the aeroplane surfaces themselves. The rôle of the stabilizer is essentially that of intervening in case of rapid perturbations.

In regard to the mathematical theories of M. Doutre which have been developed in an interesting manner, one can raise several objections in detail. I am assured that most of the expressions in respect to aeronautical terminology are not sufficiently fixed and that M. Doutre employs some which depart a little from general usage. But these are criticisms of form and not of foundation.

The best argument in support of M. Doutre's conception is the prolonged experience, and to my mind it is conclusive as to the value of his stabilizer. For several months it has been used on machines of which the stability is not ideal and under atmospheric conditions often troublesome. The results have always been excellent, and I can only wish the greatest success to the Doutre stabilizer and base upon its employment the greatest hopes for the safety of aviators.

In an address delivered at the inauguration of the Aerodynamic Laboratory of Auteuil, March 19, 1912, M. Eiffel, after describing

how he overcame some of the difficulties connected with the very successful work in his laboratory at the Eiffel Tower, on the Champ de Mars, made the following significant remarks:

I intend to follow up my researches on stability, already commenced. This is a subject of primary interest in aeronautics at present. It is an obstacle which must be overcome, for the good of aviation, and I am confident of our success.

I am confirmed in my belief, among other reasons, by the results actually obtained by M. Drzewiecki, who, guided solely by our experiments at the Champ de Mars, has arranged a disposition which realizes automatic longitudinal stability. This was tried out the other day with a model carefully made to the 1/10th scale and freely suspended in horizontal equilibrium at its center of gravity around which it could oscillate in the air blast of the laboratory. Under these conditions the equilibrium was disturbed in various ways and the model returned instantly and very positively to the normal position. The experiment was very encouraging.

One of Mr. Eiffel's recent interesting discoveries is a confirmation of the results obtained by Professor Langley with respect to the inherent stability of his successful motor-driven model with tandem planes. M. Eiffel has found that when the planes are properly located and proportioned and the rear plane set at an angle of 2½ degrees with the front plane, the longitudinal stability is improved and the sustentation is even greater, at certain angles of inclination, than that of a monoplane of the same area.

In view of all the facts and accomplishments up to date it seems to me that the outlook for *safety in flight* and the sane progress of aviation is very bright and that the spirit of unrest in France on the subject of safety is more of a healthy indication than otherwise.

LANGLEY DAY.

An address delivered on Langley Day, May 6, 1912, at Chevy Chase Club, under auspices of Aero Club of Washington.

In reviewing the subject of aviation on Langley Day from a naval viewpoint, it is appropriate to quote the trite words of a recent writer,* as follows:

Warfare to-day is a question of science against science, of education and training against education and training. It is largely an engineering proposition and is altogether an economic and a business proposition.

This quotation would be equally true if the word *aviation* were substituted for *warfare*.

* Mr. Hudson Maxim in *Aircraft*, May, 1912.

In view of the valuable pioneer work of Langley, under the auspices of the government, for the scientific development of aviation, why is it that the name of Langley and the value of his work is so little appreciated among his countrymen generally? The reason is this: He was so absorbed and zealous in his work that he had little time or inclination for providing representatives of the press with the usual pabulum that would enable these agents of popular demand to furnish the necessary thrills of sensation demanded by the average reader. The result was that, in spite of his success, the few hitches that occurred were placed before the people in a disadvantageous light and even held up to ridicule.

Nevertheless, his work and his fame and, incidentally, the credit that belongs to the country through his efforts are honored abroad, if not at home.

Now what caused the revival of aviation in this country? It was public interest in the achievements of the Wright brothers, not so much through what they accomplished here as what they and Glenn H. Curtiss demonstrated abroad. The American public was awakened then by the pride of American success in competition abroad, and the press has ever since endeavored to supply the demand for startling feats of American prowess to such an extent that the *scientific* aspect has been overshadowed by the *spectacular*. The result is that without the same encouragement in development for military purposes that has been given abroad, through natural causes, this noble art, which is so pregnant with engineering possibilities is regarded largely, in this country, as finding its most useful application here among the acrobats and hippodrome performers.

This, to my mind, has diverted attention from the most useful sphere of aviation and in some respects has done more harm than good.

What is the naval viewpoint of aviation and what has been accomplished?

Before making use of this new art it was clearly desirable to demonstrate whether or not aeroplanes could be used successfully in scouting, in communicating between a fleet commander afloat and a commanding general on shore, and whether or not they could discover an enemy's submerged mines and torpedo craft.

That all this will be possible is now practically assured. The eyes of the fleet may thus be extended far beyond the old limits

at a comparatively small outlay. But the machine must be such as may abide with the ships for the sake of the constant instruction, training, tests and demonstration that are necessary in order to make efficient use of them in the maneuvers. The first thing to accomplish then was to obtain vehicles with which constant training could proceed from the ships themselves, surrounded as they usually are, by ideal aerodromes, the water.

This could be done satisfactorily by the hydro-aeroplane or "airboat" only, and it is gratifying to note that in this respect we have led the world. I may say, in fact, that little interest was manifested in naval aviation abroad until the success of our small beginning was known there. Very recently, it has been taken up seriously and actively in France, England, Germany, Russia, Italy and Japan.

Some good scientific work has been done in the investigation of hydroplane models at the Naval Model Basin here in Washington, and this basin has demonstrated that it is a fine asset to the development of aviation in this country.

These models are being tested on the three machines that have been purchased from our small appropriation, and tests of wireless or radio apparatus are proceeding in conjunction with other experiments and the little instruction we can give with a small outfit, before such machines are issued to the ships for service use.

In the second place, it was natural that a mariner should regard with skepticism any effort at aerial navigation while yet there existed any doubt as to the possibility of directing a flight accurately from one point to another, over sea or at night, or in a fog.

Little attention has been paid by believers in aviation generally to the fact that an aviator was unable to navigate, under such circumstances (except in a calm) by the ordinary mariner's compass, notwithstanding the lamentable example of Cecil Grace, an American, who was lost about a year ago, while endeavoring to fly across the English Channel in a fog. There are officers in the navy to-day who look upon naval aviation as farcical because they do not yet know that an instrument can be provided by which an aeroplane may be navigated out of sight from a ship at sea with a reasonable surety of her being able to go where sent and to return to the ship that sent her.

But this important instrument, the airship compass, is now practically assured through the efforts of the American Navy in the development of naval aviation.

The next point to be sure of was that of *reliability* in long flights, which has chiefly to do with the improvement of motors, and, although it is now only a very close approach to an accomplished fact, it is a purely scientific problem and one which, through my knowledge of what is being done in the United States today, leaves no room for me to doubt that a thoroughly satisfactory development may be looked for in the near future.

The last point is the question of *safety* in flight. The advent of the airship compass will practically settle the navigational aspect of this question, but from the maneuvering standpoint that of airmanship, semi-automatic control, combined with good thing remains to be done. The solution is clearly evident to my mind and rests with a more general use of scientific instruments in the control of equilibrium. The machines are sure to be improved in stability but are safe enough at present if the instruments, already available for the safe control of equilibrium are used by those aviators whose ambitions lead to greater fields of usefulness than those of acrobatic stunts. In long flights, flying will be safe when the aviator is able temporarily to be relieved from much of the physical tension and strain of uncertainty by the use of scientific mechanical agencies. In my opinion, aviation will soon be as safe as automobiling, and its sphere of usefulness will be extended far beyond the limits of good roads.

Now, aviation in this country and naval aviation in particular has had a fair beginning only, and no further substantial progress can be made, in competition with other countries, until we continue the work inaugurated by Professor Langley on scientific lines.

It is pertinent to note that some of the results obtained by M. Eiffel very recently, at his aerodynamic laboratory in Paris, confirm the discoveries of Langley in a remarkable degree. I refer particularly to the tandem arrangement of planes which, in Langley's motor-driven model, showed great longitudinal stability. This arrangement has appealed to me for some time as possessing features sufficiently advantageous for airboats to be worth investigation, but I have been met by clouds of mathematical demonstrations, by both English and French investigators, tending to prove a theoretical inefficiency of this arrangement. Now comes M. Eiffel, with the facilities of his laboratory, to make it clear that when such surfaces are properly proportioned and set at a proper distance apart, if the following surface is set with its chord at a

negative angle of 2½ degrees with the leading surface, the longitudinal stability is improved and the sustentation is not only equal to that of a monoplane of the same area, but for certain inclinations is greater, and Langley's work is vindicated beyond expectation.

In an address to the 5th International Aeronautic Congress, at Turin, August 11, Commandant Renard, President of the International Aeronautic Commission, stated that *aerodynamic laboratories* have existed for several years in different countries, and he noted that they exist in the United States, having in mind, of course, the world renowned work of Professor Langley and believing that it still continued at the Smithsonian Institution.

To revive and continue this work in accordance with the spirit of foreign progress, the establishment of a modern national aerodynamic laboratory is necessary. The facilities here in Washington exceed those of any other country in the world. It is possible to establish here, at a comparatively small cost, an ideal institution which will co-ordinate the work, not only for the best interests of commerce and business, but for the best interests of both the army and the navy.

This, in my opinion, is one of the most important steps yet to be taken and, when inaugurated, the laboratory should be dedicated to the memory of *Langley*.

THE LATEST DISCOVERIES OF M. EIFFEL.

Notwithstanding the importance of the results obtained last year by M. Eiffel, in his aerodynamic laboratory at Paris, his recent discoveries, at the same place, promise more for the progress of aviation than any other information obtained throughout the year.

ASPECT-RATIO AND CENTER PRESSURE.

The results of his latest experiments show the relation between the efficiency of an aeroplane wing and its aspect-ratio. The efficiency of a wing of given curvature increases with the aspect-ratio of the wing until the aspect-ratio of 6 is reached. The results are nearly the same for the aspect-ratios of 6 and 9, and it does not seem that there is any advantage, therefore, in designing a wing with a span greater than 6 times its chord or depth.

In last year's disclosures he showed that the position of the center of pressure of a curved surface gradually moves forward

towards the leading edge, as the angle of incidence diminishes, until a certain inclination is reached, when it travels backward towards the following edge as the angle of incidence is further diminished. The angle at which this change in the travel of the center of pressure takes place has been designated "the angle of retrogression" and, for a curved surface, has now been found to vary with the aspect-ratio. Thus, for a particular surface it is found that with an aspect-ratio of 6 the angle of retrogression is 15 degrees, that it is 30 degrees when the aspect-ratio is 1 and 60 degrees when the aspect-ratio is $\frac{1}{6}$.

The general conclusion is that for inclinations of the chords of the surfaces beyond 15 degrees—such as are met in the practice of aviation—the center of pressure travels towards the following edge as the angle of incidence diminishes.

The lack of longitudinal stability in many existing aeroplanes has been ascribed to this cause, and it was in search of a remedy that a wing curvature has been sought whereby the center of pressure would not travel backwards in this manner. M. Eiffel's discoveries now confirm the claims of the Italians in respect to the flexible rear edge of the Antoni machine and of others. He finds that, in the case of wings having a double curvature, the back portion of which is turned upward, the center of pressure for small angles travels in a direction the reverse of that of ordinary surfaces with single curvature, *i. e.*, for small angles of inclination the center of pressure travels forward as the angle diminishes and backwards as the angle increases. This is important, as it increases the natural stability of the machine. If for some reason during a flight an aeroplane with a double curvature wing suddenly dips forward, the angle being diminished, the center of pressure travels forward and tends to restore the machine to its original inclination. If, however, the inclination is suddenly increased, as by an upward puff of wind, the center of pressure moves to the rear to restore equilibrium.

But these surfaces of double curvature have a relatively small "lift co-efficient," and he shows that this is also true for surfaces which embody varying angles of chord inclination.

Experiments with a single curvature wing, having chords varying regularly and continuously from the center line towards the lateral edges, show that, for all practical purposes, the position of the center of pressure is constant within the limits of inclination

which interest practical aviation. This is due to the fact that the center of pressure of the whole wing is the resultant of the combined centers of pressure of the different parts making up the whole wing. But, as before stated, the experiments show that wings with varying angles of inclination, although more stable, are not very efficient. This result is what one would naturally expect because the different portions of such wings do not work together simultaneously for efficiency at the best inclination.

TANDEM WINGS.

One of the most interesting discoveries is this late vindication of Professor Langley's work, notwithstanding the volumes of mathematical fog that have been evolved to show that tandem planes are unstable and inefficient.

Some of M. Eiffel's interesting experiments prove that when curved wings are made to move in tandem it is possible to obtain a displacement of the resultant center of pressure in a direction contrary to that of the single wing and that it is possible thus to obtain the efficient lift co-efficient of "unvarying" surfaces and at the same time to increase their longitudinal stability.

Three different arrangements are referred to, but in all cases the wings were of a circular curvature with a maximum camber of 1/13.5 of the chord, and they had a span of 90 cm. (35.4") with a depth of 15 cm. (5.9"). In the first arrangement the two wings were parallel to each other and the chords were in the same plane. In the second the chord of the following surface made a negative angle of 2½ degrees with the chord of the leading surface. In the third arrangement the chord of the following surface made a negative angle of 5 degrees with the chord of the leading one. In all three cases the distance between the following edge of the leading surface and the leading edge of the following surface was twice the depth of either surface.

In the first arrangement the displacement of the resultant center of pressure is found to be similar to that of a single curved surface, *i. e.*, for small angles of incidence it moves backwards as the inclination diminishes. The second and third arrangements, however, show that the center of pressure, instead of retrograding as in the preceding arrangement, travels forward, a result which is advantageous for longitudinal stability. The second arrangement (2½ degrees negative for the rear surface) is the better, its sustenta-

tion being equal to that of a monoplane of the same area, and for certain inclinations it is even greater.

STAGGERED PLANES.

Two series of experiments were made with regard to staggered planes, with the following results:

(1) It does not seem advantageous to stagger biplanes for the purpose of improving sustentation.

(2) A great gap, or distance between superposed surfaces, is advantageous so far as lift is concerned.

THICKNESS OF WINGS.

To determine the influence of wing thickness on the lift and drift, comparative experiments were made with three wings, the curves of which were arcs of circles and the greatest mean heights of camber were 1/13.5 of the chord.

The models of these wings were 10 mm. (.39″), 14 mm. (.55″) and 18 mm. (.6″) thick respectively at their central section and the thickness of corresponding full-sized wings ten times the model scale would be 10 cm. (3.9″), 14 cm. (5.5″) and 18 cm. (6.0″) respectively. Examination of the results relating to the three wings shows that for all inclinations the thinnest wing has the smallest drift for a given lift and that it also has the greatest lift. However, the advantages of the thin wing are not so great as to prevent increasing the strength of the wing by slightly increasing its thickness.

The distribution of pressure on the under as well as on the upper surface is practically the same in all three cases, and this is also true with respect to the variation in the position of the center of pressure.

FRANCE
Genoa
Spezia
Venice
Leghorn
Ancona
BLACK
Sea
CORSICA
ELBA
Rome
Gaeta
Naples
SARDINIA
ASIA
MINOR
Bizerta
Palermo
SICILY
Tunis
RHODES
MALTA
Bay

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ITALIAN-TURKISH WAR.

By Commodore W. H. Beehler, U. S. Navy (Retired).

(Compiled and translated from the *Marine Rundschau*, and other sources.)

Italy declared war against Turkey for commercial reasons and to provide a neighboring colony for her surplus population. The Italians believe the prediction of the great African Explorer, Gerhard Rohly, who, twenty years ago, declared that the power that rules Tripoli will dominate the Soudan. The proximity of Tripoli to Italy makes its possession desirable.

The importance of the region was recognized by the ancient Romans. Cyrenaica was very important. The five great commercial ports were known as the Lybian Pentapolis, and existing ruins of great works, aqueducts, dams, and large buildings reveal its ancient prosperity. Sallust states that Leptis alone annually exported forty million bushels of grain and paid a war tax of twenty-five thousand gallons of olive oil. The Mediterranean climate prevails, and though the great Saharan Desert approaches close to the coast there are large oases and fertile tracts of land that would enable the country to support a population of twelve million inhabitants, whereas it now has but one million.

This coast has a number of naturally fine harbors that have been filled up with sand and ruined by neglect, but which could easily be reclaimed. Such are Tripoli, Lebda, Misrata, Benghasi, Derna, Mersa, Bomba and Tobruk. The trend of the coast brings the Tripolitan ports three hundred miles nearer the trade centers of points around Sahara, and the trade routes converge towards Tripoli.

Ever since the Kingdom of Italy was united Italy has coveted the adjacent coast of North Africa. Forty years ago Bismarck wrote to Mazzini: "The Mediterranean is indisputably Italy's sphere of interest. The control of the Mediterranean should be the constant goal and the controlling principle of Italian statesmen!" England had long possessed Malta and Gibraltar. In 1878 she acquired Cyprus while Austria took Bosnia. At the Berlin Congress

Bismarck and Beaconsfield offered Italy Mythelene, Tunis and Tripoli; but Cairoli declined, stating that he wished to leave the Congress with clean hands. Other nations, however, stepped in and took forcible possession. France inaugurated her Algerian imperial policy and acquired Senegal, Tschad, and Tunis. France fortified Biserta on the Tunisian coast and is now proceeding to peaceably acquire Morocco. During the Russo-Turkish war England offered to form a league with Italy, Austria and Greece to maintain the *status quo* in the Mediterranean, but Italy declined because she did not wish to disturb her friendly relations with other nations. In 1881, when France seized Tunis and broke the *status quo,* Italy claimed to be too weak to make any serious protest but, at the renewal of the triple alliance in 1866, Italy complained that Germany and Austria did not protect Italy from French encroachments in the Mediterranean. Bismarck then is said to have negotiated a secret treaty with England stipulating that Italy's interests in the Mediterranean should be preserved. In 1889, however, England negotiated the Soudan treaty with France defining boundaries that encroached still further on the borders of the Tripolitan hinterland. In a secret treaty in 1902, England and France recognized Italy's claims to Tripoli. In 1904 France definitely proclaimed Italy's prior right to take possession of Tripoli under certain contingencies. During the Bosnia-Bulgarian crisis Italy was supposed to take definite action but Italy hesitated because of England's relations with the Young Turk government, but since England's attitude has cooled somewhat, Italy has finally acted to be no longer reproached for neglecting her opportunities. These diplomatic incidents explain the present neutrality of European powers.

The Turks have had possession of Tripoli since 1835, and the inhabitants regard Turkish rule as a blessing; they have enjoyed greater freedom and have been subjected to much less burdensome taxation than before. The protectorate of Tripoli is an expense rather than a source of revenue for Turkey. The expenses of administration are greater than the revenue from harbor dues and agriculture. The Turks relieved the people of military service at first, but in 1901 universal compulsory military service was re-established and occasioned some opposition, but this has been long since settled as a necessary feature of the government. The alleged Italian claim that the country is misgoverned and that intolerable conditions exist are not well founded.

The Berbers were the original inhabitants of the entire North African Coast as far as Morocco. These were joined by a large emigration of Jews after the Babylonian captivity. The Jews number about 20,000 or one fiftieth of the estimated population of one million. These Jews live in the cities and are the leading merchants, a few carry on small industries in the interior. The Arabs invaded, not in great hordes but by single tribes, from time to time, when compelled by famine to leave their former abodes. These tribes captured places from the numerically superior Berbers who were scattered, and gradually they have amalgamated so that it is rare to find either pure Berbers or pure Arabs in the country. The negro population is estimated at 50,000. There are 15,000 Spaniards; 50,000 Turks, Armenians and Albanians; 3000 Maltese, and only 1000 Italians; the rest are Berber-Arabs.

The Turks are chiefly officials or in the army. The Armenians and Maltese compete with the Jews in the trade. The Italians are far behind all other traders. They have a flour mill, an oil mill, one soap factory and an asparagus press, which are supported by the Bank of Rome at a loss. The export trade with Italy is valued at $600,000, while the imports from Italy only amount to $400,000 per annum. England has the bulk of the commerce.

The population is extremely fanatical and bitterly opposed to the Italians. The All-Islam propaganda has aroused the religious fanatics, who are so extremely bigoted that they do not regard the Turks as true Moslems, and some of the opposition to the Turkish rule was because the Turks are not orthodox Mahomedans. The fact might be used to favor the Italians if managed with a delicate diplomacy, but the conciliation of the people is a very difficult task.

The country is agricultural and can only be made profitable by developing its agricultural resources. Tobacco, cotton, silk, olives, wine and dates could be profitably cultivated but such can hardly be expected of the Italians, who have failed to agriculturally develop Italy, and in all countries to which Italians have emigrated they are rarely found to be successful agriculturists. The negro is much better qualified for this development, and even more so are the Berber-Fellachens, who are acclimated and familiar with conditions of the soil.

Tripoli is important because of the possibilities of its hinterland, though much of the important trade that would have its natural outlet through Tripoli has been secured by France through Algiers

and by England through Egypt. The boundaries of the English and French spheres of influence in the Soudan and around the hinterland of Tripoli limit its importance to the coast.

Italy has a precarious problem in the conquest of this hinterland. France has operated under most favorable conditions to develop her Algerian policy and in the last ten years after indefatigable labor France has succeeded. How will Italy manage is problematical. Italy has a most formidable foe in the tribe of Fessans who, though numerically inferior and provided with inferior weapons, are thoroughly accustomed to the hot, dry climate, are a warlike race, very mobile, and possess a knowledge of the country that will outweigh the superiority in numbers and equipment of the Italians. Racial sympathy and the fanatical religious zeal will add to make them almost invincible in the defence of their native land. Guerilla warfare will be sure to prolong the war should the Italian armies overcome the organized defence so that the peaceful agricultural development must be long deferred. Finally trade relations with the interior will cause friction in Italian competition with the English and French; and influence relations of the European powers.

England with her chain of naval bases at Gibraltar, Malta, and Suez Canal communications has regarded the Mediterranean in a measure as a *Mare Clausum* and she cannot favor the establishment of formidable ports on the other flank of this line. The British Mediterranean fleet has of late years been reduced and greater attention been given to the North Sea, whereas now the Mediterranean will require more attention. England and France will increase their Mediterranean naval forces while Italy will lean more than ever upon the Central European powers and the triple alliance, in which Germany is so much interested, will be strengthened.

ITALY'S AVAILABLE NAVAL FORCES WHEN WAR WAS DECLARED.

THE SEA-GOING FLEET, VICE-ADMIRAL AUBRY, COMMANDING.

1ST SQUADRON, VICE-ADMIRAL AUBRY, ORGANIZED FOR WAR.

1ST DIVISION.

Battleship,	Vittorio Emanuele, flagship.
"	Regina Elena, joined Oct. 5, 1911.
"	Roma.
"	Napoli.

2D DIVISION, REAR-ADMIRAL PRESBITERO.

Armored cruiser,	Pisa, flagship.
"	Amalfi.
"	San Marco, joined Oct. 1, 1911.
"	San Giorgio, repairing in Spring, 1912.
Torpedo ship,	Agordat.
Minelayer,	Partenope.

2D SQUADRON, VICE-ADMIRAL FARVELLI, COMMANDING.

3D DIVISION.

Battleship,	Benedetto Brin, flagship.
"	Regina Margherita, joined Oct. 5, 1911.
"	St. Bon, subsequently transferred.
"	Emanuele Filiberto, ready Sept. 30, 1911.

4TH DIVISION, REAR-ADMIRAL THAON DI REVEL.

Armored cruiser,	Garibaldi, flagship.
"	Varese.
"	Ferrucio.
"	Marco Polo, subsequently transferred.
Torpedo ship,	Coatit.
Minelayer,	Minerva.

DIVISION OF TORPEDO BOAT INSPECTOR.

REAR-ADMIRAL, DUKE OF ABRUZZIA, COMMANDING FOR WAR.

Armored cruiser,	Vettor Pisani, flagship.
Battleship,	St. Bon, transferred from 3d division.
Armored cruiser,	Marco Polo, transferred from 3d division.
Prot. cruiser,	Lomdardia, submarine's mothership.
Destroyer,	Artigliere, from destroyer flotilla.
"	Fuciliere, " " "
"	Corazziere, " " "
"	Alpino, " " "
"	Zeffiro, " " "

High sea torpedo boats, four to eight, from destroyer flotilla.

TORPEDO FLOTILLAS OF THE SQUADRON.

320 tons,	Ostro,	first division.
"	Freccia,	" "
"	Lampo,	" "
"	Euro,	" "
330 tons,	Nembo,	second division.
"	Turbine,	" "
"	Borea,	" "
"	Aquilone,	" "

416 tons,	Alpino,	third division.
"	Pontiere,	" "
"	Carabiniere,	" "
"	Fuciliere,	" "
400 tons,	Bersagliere,	fourth division.
"	Granatiere,	" "
"	Garabaldino,	" "
"	Lanciere	" "

DESTROYERS IN RESERVE.

330 tons,	Zeffiro,	at Spezia.
"	Espero,	" "
400 tons,	Artigliere,	at Tarento.
"	Corazziere,	" "
320 tons,	Strale,	at Venice.
"	Dardo,	" "
300 tons,	Fulmine,	at Leghorn, schoolship.

28 high sea torpedo boats.

TRAINING SHIP DIVISION, REAR-ADMIRAL BOREA-RICCI, COMMANDING.

Battleship,	Sicilia, flagship.
"	Sardegna.
"	Re Umberto.
Armored cruiser,	Carlo Alberto.

OTHER AVAILABLE NAVAL VESSELS.

Coast defence ship,	Dandolo,	forming a fifth division.
" " "	Italia,	" " " "
" " "	Lepanto,	" " " "
Protected cruiser,	Elba,	Red Sea.
" "	Puglia,	" "
" "	Etna,	" "
" "	Liguria,	" "
" "	Pimeonte,	" "
Gunboat,	Governolo,	" "
"	Gal. Galilei,	station, Constantinople.
Minelayer,	Tripoli,	at Venice.
"	Goito,	" "
"	Montebello,	" "
Torpedo ship,	Urania,	at Naples and Spezia.
" "	Iride,	" " " "
" "	Caprera,	" " " "

Coast torpedo boats, about 60 in all

Submarines, 5 at Brindisi, 2 each at Spezia and Venice.

AUXILIARIES.

Collier,	Bronte.
"	Sterope.
Transport,	Citta di Milano.
"	Carigliano.
"	Volta.

Repair ship, Vulcano, at naval base, Augusta.

SHIPS STATIONED ABROAD.

Gunboat,	Arethusa,	in the Red Sea.
"	Volturno,	" " " "
Survey ship,	Stafetta,	" " " "
Prot. cruiser,	Calabria,	in East Asiatic waters.
" "	Etruria,	in American waters.

TURKEY'S AVAILABLE NAVAL FORCES ON SEPTEMBER 15, 1911.

BATTLESHIP DIVISION.

Battleship,	Babarossa Heireddin,	(91)	10,060 tons
"	Torgut Reiss,	(91)	10,060 tons

CRUISING SQUADRON.

Prot. cruiser,	Hamidje,	(03)	3800 tons
" "	Medjidije,	(03)	3200 tons

TORPEDO BOAT FLOTILLA.

Destroyer,	Jadighiar-i-Millet,	(09)	620 tons
"	Nemune-i-Hamie,	(09)	" "
"	Muavenet-i-Millije,	(09)	" "
"	Taschos,	(08)	305 tons
"	Basra,	(08)	" "
"	Samsum,	(08)	" "
"	Yar Hissar,	(08)	" "
Torpedo mother,	Tir-i-Mugguian,		4052 tons

RESERVE DIVISION.

Battleship,	Messudije,	(74)	(03)	9250 tons
Coast defence,	Assar-i-Tewfik,	(68)	(99)	5700 tons
" "	Feth-i-Buelend,	(71)	(07)	2800 tons
" "	Awnllah,	(69)	(07)	2400 tons
Destroyer,	Pelenghi Deria,		(94)	900 tons
"	Berc-i-Sawet,		(07)	750 tons
"	Gairet-i-Watanije,		(09)	620 tons

DETACHED TORPEDO BOATS.

Anatalia,	(06)	160 tons
Takat,	(06)	" "
Ursa,	(06)	" "
Ankara,	(06)	" "
Dratz,	(06)	" "
Kutahia,	(06)	" "
Mussul,	(06)	" "
Alpagot,	(04)	" "
Al Hissar,	(04)	" "
Abdul Medjid,	(01)	145 tons
Junus,	(01)	" "
Hamid Abad,	(08)	97 tons
Sivri Hissar,	(08)	" "
Sultan Hissar,	(08)	" "
Timur Hissar,	(08)	" "

STATIONED IN HARBORS.

Coast defence ship, Muin-i-Zafer, (71) (07) 2800 tons, Beirut.
Destroyer, Peik-i-Schewket, (07) 750 tons, at Hodeida.
24 gunboats of 200 to 650 tons.
20 coast torpedo boats of 40 to 85 tons.
6 special ships of 180 to 2300 tons.

THE TURKISH GARRISONS IN TRIPOLI AND CYRENAICA.

The Turkish Army stationed in Tripoli and Cyrenaica was composed of the 42d Division consisting of, viz:

4 regiments of infantry = battalions of 600 each.
1 battalion of chasseurs.
2 regiments of cavalry = 10 squadrons of 80 to 120 horses.
1 regiment of field artillery = 6 batteries of 4 to 6 field guns of 7.5 cm., or 3-inch guns.
4 companies of engineers.
3 companies of fortress artillery.

The complement was 12,000, but at the outbreak of the war the trained troops numbered about 5000 infantry and 400 cavalry with about 2500 to 3000 raw recruits.

The garrison of the city of Tripoli consisted of:

6 battalions of infantry with two machine gun companies.
1 battalion of chasseurs.
6 field batteries.
4 squadrons of cavalry.
2 companies of fortress artillery.

This organization called for 6000 troops, but at the outbreak of the war there were but 3000 trained troops with about 2000 raw recruits.

The garrisons in other parts of the province were distributed in small detachments. It is reported that just before the war Benghasi had 400; Derna, 70; Tobruk, 30; Solum, 25, and Cyrene 10 men.

In addition to these regular troops the territorial troops were organized in 30 battalions of infantry and 60 squadrons of cavalry with a total strength of 20,000.

These combined gave a total strength of the Turkish forces at 28,000 men.

The regular infantry was until recently armed with an old model of Mauser rifles, but recently they have been supplied with the latest model of Martini rifles, and the Mauser rifles have been given to the irregular troops. During the latter part of September about 10,000 of these old Mauser rifles were sent into the interior for the territorial troops. The Turks have 50,000 rifles and ample ammunition.

THE DEFENCES OF THE CITY OF TRIPOLI.

The defences consisted of five old coast fortifications and some newer earthworks on the land front. On the west side Fort Sultanje and Fort Gargaresch comprised a group of three old earthworks carrying modern Krupp guns. Italian reports state that these included some 21-cm. howitzers. Fort Sultanje protected the cable landing from Malta. There was a group of old stone forts near the town on the north, there consisted of: (1) The Lighthouse Fort whose walls were mounted with three old 15-cm. guns with the lighthouse built on the same wall; (2) The Spanish Fort on the harbor mole, and (3) Fort Rosso, west of the Lighthouse Fort (so-called because of its red walls). Forts 2 and 3 were armed with old small-caliber guns.

Fort Hamidije or Scharaschat is about 6000 yards east of the city on a bluff fifty feet above the sea level, an old earthwork that commands the outer roadstead and the harbor. The four modern guns which were formerly mounted in this fort were taken to Yemen in 1905 and replaced by four old howitzers. Latest reports state that the Italians found one 24-cm., one 15.2-cm. and one 9-cm. guns in this fort. Field Marshall von der Goltz states that in 1911 the defences of Tripoli had no guns larger than 15 cm., made in 1870.

A wall 25 feet high, built in the 16th century, encloses the inner city. The land forts encircle the town in a series of earthworks commanding the roads leading into the country.

THE MILITARY CONDITIONS AT TRIPOLI.

The lack of heavily armed modern fortifications and the weakness of the garrison, with the easily interrupted line of communication with Turkey, rendered any attempt to defend the city from an oversea attack by the Italians hopeless at Tripoli, and even more so at the other ports.

The defence was still further hampered by lack of food. The Turkish-Tripolitan troops had long been subsisted by commissary stores from Constantinople. The failure of the crops in recent years was such that the Turkish government was also obliged to subsist the poor people. The starving people were supplied with rations from two large tents at the gates of the city.

The Egyptian railroad only extends about 200 miles west of Alexandria with its terminus at Mersah Matruh, which is about 800 miles from the city of Tripoli, so that the Turkish request of England for permission to send Turkish troops to Tripoli through Egypt could not be of much practical value.

It would have been better to have organized Turkish defence against the Italian invasion back from the coast. Field Marshall von der Goltz claims that the real defence of Tripoli is in the interior. The regular forces, though few in number, would be insufficient. The resistance must depend chiefly on the native population, especially with the support of the Shiek Sidi-es-Senoussi, who had been recognized as the ruler of Djarabul, on the borders of Barka. The Shiek of Senoussi at first hesitated to oppose the Italians.

ORGANIZATION OF ITALIAN-TRIPOLITAN EXPEDITIONARY CORPS.

The partial mobilization of the Italian army for the Tripolitan expedition was with the 7th and 12th Italian army corps, chiefly from the cities of Palermo, Rome, Naples, Florence, Verona, Milan, and Turin. Entire regiments were taken from these cities, and volunteers increased the regimental strength to the war footing of 2600 men. The standing army was reinforced by calling out the category of reserves of 1888. 80,000 reserves were thus added to the army stationed at home.

The expeditionary corps consisted of the following:

COMMANDER-IN-CHIEF: LT.-GENERAL CANEVA DI SALASCO.

CHIEF OF STAFF: MAJOR GENERAL GASTALDELLO.

FIRST DIVISION OF INFANTRY, LT.-GENERAL COUNT PECORI GERALDI.

1st brigade.	*2d brigade.*
82d infantry.	6th infantry.
84th infantry.	40th infantry.
3 squadrons of cavalry.	6 batteries field artillery.

SECOND INFANTRY DIVISION, LT.-GENERAL BRICCOLA.

3d brigade.	*4th brigade.*
22d infantry.	4th infantry.
68th infantry.	63d infantry.
3 squadrons of cavalry.	6 batteries field artillery.

Under direct command of expedition commander:

The 8th regiment Bersaglieres.	1 battery mountain artillery.
The 11th regiment Bersaglieres.	Several batteries field artillery.
One battalion of engineers.	One telegraph company.
One machine gun detachment.	Wireless telegraph personnel.

A company of infantry has about 200 men so that the total force was about 40,000 men. They had 11 flying machines of French types. The Italian infantry had a 6.5-cm. repeating gun of Mannlicher-Carcano type M-91. Each soldier carried 162 cartridges besides which the transports had 24 cartridges per man additional. Each company carries 105 intrenching tools of which 80 are spades. The transports had 144 intrenching tools per battalion additional.

The Italian field artillery had 7.5-cm. Krupp guns M-1906. The troops had a special grayish-green uniform. After September 27th the Italian railroads were crowded with troops assembling for the expedition. A smaller detachment of troops was embarked in the transports at Naples, Syracuse and Augusta on September 26, to be ready for emergency.

DECLARATION OF WAR AND NOTICE TO NEUTRALS.

At 2.30 p. m., September 28, the Italian Chargé d'Affaires in Constantinople presented the Italian Ultimatum to the Turkish government. This declared that in order to terminate the disorders and neglect caused by the Turkish Government in Tripoli,

and Cyrenaica, the Italian government demanded that Turkey should, within 24 hours, consent to Italy's military occupation of those provinces. The Turkish government refused and at 3 p. m., September 29, the Italian government declared war between Italy and Turkey.

The Italian government proclaimed its purpose to take prompt measures for the protection of Italians and all foreigners in Tripoli and Cyrenaica.

Neutral powers were notified that the Tripolitan and Cyrenaican coast were blockaded.

Within a few days France, Russia, Belgium, Spain, Portugal, Servia, Bulgaria, England and Japan issued neutrality proclamations.

The French declaration of neutrality stated that it comprised the French protectorates including Crete. The English and Russian governments endorsed the French proclamation, and Italy was freed from the protection of the Island of Crete.

The orders of the Turkish government to extinguish the coast lights and remove sea marks on the coast of Crete were annulled by the united action of all consuls in Crete before the neutrality proclamations.

England declared the island of Cyprus neutral, and issued orders for all British subjects not to serve in the armies of the belligerents. In the middle of October Italy recognized the neutrality of the island of Samos.

THE ITALIAN NAVAL PROBLEM.

Before the war began Italy notified her ministers to the Balkan states that Italy's only object was to take possession of Tripoli and Cyrenaica, and she would avoid any attack upon any other Turkish territory. The destruction of Turkey's naval and military forces was only contemplated in as far as they opposed Italy's conquest of Tripoli and Cyrenaica.

The Italian naval task was to secure such a command of the sea that the expedition corps might safely be transported and landed on the African coast and communication with Italy be undisturbed.

This task furnished three fields of operations:

1. The Tripolitan waters, by which the expedition corps would land. The bulk of the navy was employed there.

2. The eastern Mediterranean, especially the Aegean sea where

the Turkish fleet had assembled and which must be prevented from interfering with the landing of the Italian forces. For this purpose light scouting vessels were used.

3. The Albanian coast where a number of Turkish torpedo-boats should be held in check. For this some older armored cruisers and several destroyers were used.

EVENTS ON THE TRIPOLITAN COAST AFTER DECLARATION OF WAR UNTIL THE ARRIVAL OF THE EXPEDITIONARY CORPS.

The Italian government declared a blockade of the coast of Tripoli and Cyrenaica extending from the Egyptian to the Tunisian borders. Violations of the blockade would be prosecuted according to International law and Italian treaties with other powers.

The blockade of the coast, 700 nautical miles, was made effective by 7 battleships and a number of destroyers and special ships. Ships of the blockade replenished fuel supply by going to Augusta singly as necessary. At the outbreak of war Italy had stored 14,000 tons of coal at the naval base at Augusta. The naval repair ship *Vulcano* was stationed at Augusta.

After some discussion the Turkish forces at Tripoli decided to evacuate the city with the exception of 150 coast artillery stationed in the forts. The troops began the evacuation September 27, and quietly proceeded to intrench in the hills south of the city and two days march distant. The Italians were kept informed of all that transpired in the city through the Mayor, Prince Hassuna Karamanli, who had declared his adhesion to Italy.

September 30 the Italians demanded the city should be surrendered on October 2, but this was still further postponed until October 3, at noon. No reply having been received Vice-Admiral Faravelli, in command of the naval forces, opened fire on the forts.

The *Benedetto Brin* and the training ship division, with two transports and several torpedo-boats arrived and relieved the *Roma, Pisa, Napoli* and *Amalfi* that had been blockading Tripoli, and which left to join the flagship to the eastward.

THE BOMBARDMENT OF TRIPOLI, OCTOBER 3 AND 4, 1911.

In the bombardment the *Sicilia, Sardegna,* and *Re Umberto* were assigned to engage Fort Sultanje on the west; the *Benedetto Brin, Carlo Alberto,* and *Emanuele Filberto* engaged the three old stone

forts on the sea side; and the *Garibaldi* and *Ferrucio* engaged Fort Hamidje.

The *Varese, Coatit,* and 16 destroyers and four auxiliaries were stationed to the rear and on the flanks to prevent any surprise from seaward.

Fire was opened at 3.15 at range 7000 meters, by the flagship. The forts replied immediately but all their shots fell short. The Italians fired chiefly with the 15 and 20-cm. guns, and they soon proved effective. The heavy guns were not used, probably to preserve them and avoid too much expenditure of ammunition. The hits were few and the fire very slow, many shells failed to explode and were subsequently picked up several thousand yards beyond in the suburbs.

The old stone forts ceased firing at 5 p. m., but the two outer forts continued firing until sunset, at 6 p. m.

Though the buildings in the city were avoided, fires were started in several, and the governor's palace was hit a number of times. The new lighthouse was completely destroyed. After dark the ships got under way and cruised in the offing with screened lights.

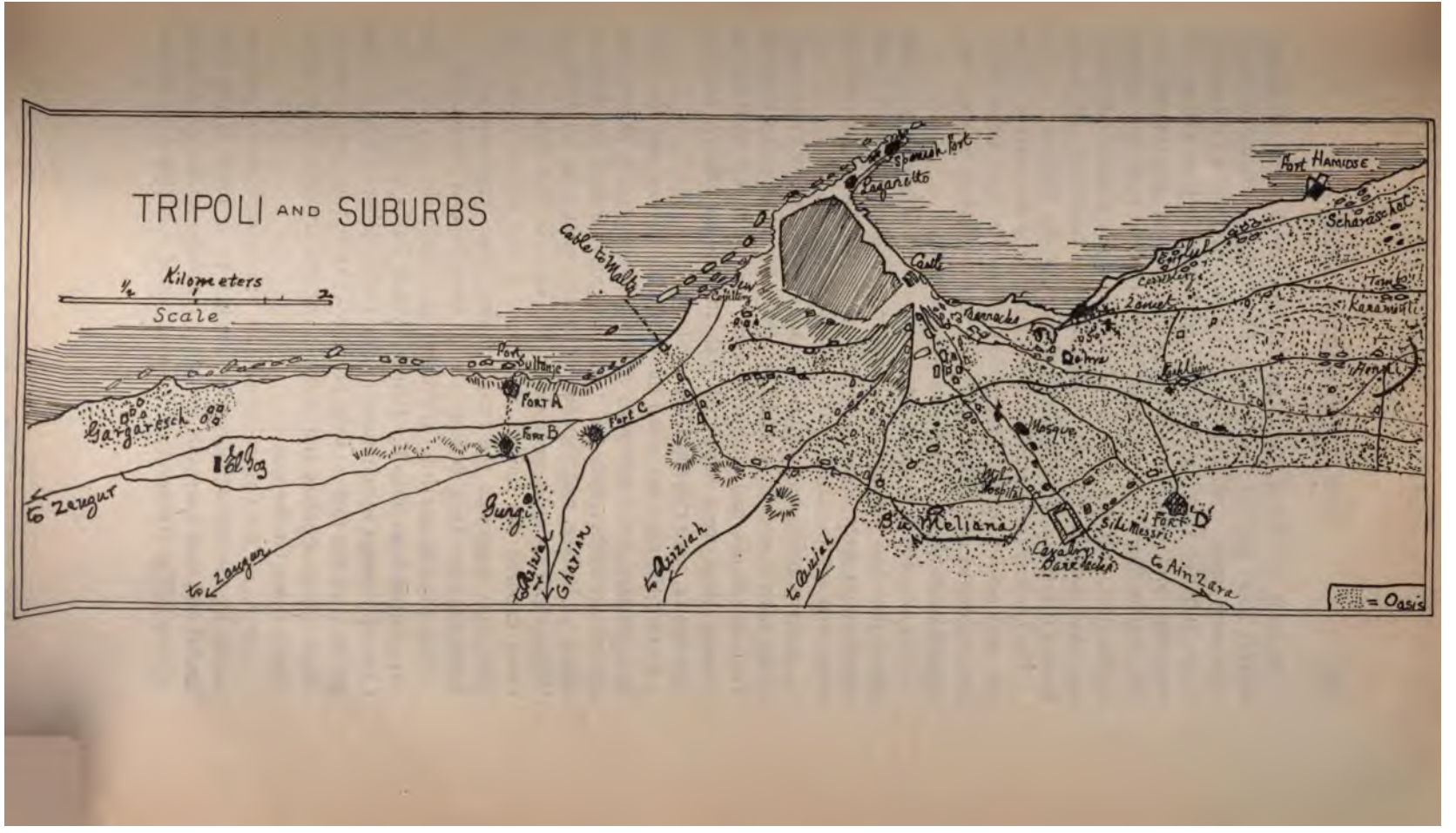
At 6 a. m. the bombardment was resumed with greater vigor, and the other forts were silenced in the following hour. Fort Sultanje made the greatest resistance. Ten dead were found in that fort subsequently.

OCCUPATION OF TRIPOLI BY THE NAVAL LANDING FORCE.

While the mob in the city sacked the government buildings, the garrison evacuated the forts taking their light guns to the heights in the southern suburbs, from which they reopened fire but were soon silenced by shrapnel from the ships. The ships ceased firing at 11 a. m. The *Garibaldi* was the first ship to enter close in and she landed a detachment with two officers in Fort Hamidje that had been evacuated by the Turks. They rendered the breech mechanism of the guns therein useless and returned on board.

At the same time a torpedo-boat searched for the cable of mines laid out in the harbor but could not find it.

All the coast forts were severely damaged and their guns partly dismounted. According to Turkish reports their garrison lost 12 men killed and 23 severely wounded. Seven civilians were killed in the city, but no Europeans. The Italian ships suffered no losses nor any damage from the Turkish fire.


TRIPOLI AND SUBURBS
Kilometers
½ 1 2
Scale
Spanish Fort
Lazaretto
Fort Hamidse
Castle to Malta
Castle
Port Sultanije
Fort A
Fort B
Fort C
Fort D
Gargaresch
El Hog
To Zenzur
To Zenzur
Gurgi
Ghariam
Bir Meliana
Mosque
Mil. Hospital
Cavalry Barracks
Sidi Messri
To Ain Zara
= Oasis

At noon, October 4, the large ships anchored in the offing and smaller ships entered the harbor. October 5, a landing force of 1200 men under command of the captain of the *Sicilia* ocupied Forts Sultanje, Hamidje and the Lighthouse Fort, as well as the consulate and other important places without any opposition. The Italian flag was hoisted on Fort Sultanje at noon and saluted by the fleet. Shortly after this Fort Hamidje's magazine blew up and that store of Turkish ammunition was destroyed. It is not known if this was done by the Italians or by the Turks.

The landing force immediately arranged for the defence of the city and established its government. Rear-Admiral Borea-Ricci was appointed provisional governor, and the former mayor, Hassuna Karamanli, was appointed vice-governor.

They proceeded to substitute a temporary lighthouse for that which they had destroyed. The cable to Malta was repaired and preparations were begun to provide quarters for the expedition corps that was expected to arrive October 11.

A native police was established, and by offering payment, some of the natives were induced to surrender the arms with which the Turkish officials had supplied them. Within a few hours 1500 Mauser rifles were deposited with the Italian officers, and by October 12, 3250 rifles had been delivered.

During the next day when the *Garibaldi, Varese,* and *Ferrucio* had departed for Augusta to coal, the landing party ashore had several skirmishes with the Turks. October 8 they repulsed an attack at Behare, and October 19 another attack at Bu Meilana Wells, about 1.5 miles southwest of Tripoli. As Fort Sultanje was much exposed the Italians abandoned it and it was blown up. The ships supported the troops during these engagements and bombarded the Turkish forts used as bases beyond the suburbs.

The Turkish garrison assembled at Gharian in the hills, two days march from Tripoli. General Munir Pasha was relieved by Colonel Neschat in command during the middle of October, who gathered all the forces of the province. At first he had a force of about 10,000 regulars and 10,000 territorial irregulars, the latter volunteering for the war.

Tobruk, on the Cyrenaica coast, a fine natural harbor was attacked by the first squadron on October 4. A force of 400 men landed and soon overcame the brave resistance of the garrison of 25 men. The Italians took possession and established an Italian

municipal administration. Single ships of the first squadron alternately remained at anchor in that harbor. October 10 the first detachment of the expeditionary army landed at Tobruk. This was the first battalion of the 40th Infantry, with some coast artillery and engineers—about 1000 in all. They had sailed from Naples October 6.

Derna was bombarded October 8, and 40 Italian citizens who were confined there were released. The place was bombarded because they had fired upon the Italian boat with flag of truce.

EVENTS ON THE ALBANIAN COAST.

Before the war six new Turkish torpedo boats were at Prevesa, Gomenitza and Durazzo to prevent smuggling. They had not received orders of the Turkish Naval Minister to take refuge in Austrian ports when they were attacked by the destroyers of the Duke of Abruzzia's command.

At 3 p. m., September 28, one hour after war had been declared the Italians sighted the two Turkish torpedo-boats, *Takat* and *Anatalia*, at sea between Corfu and Prevesa, steering northwestward. The Italians opened fire, to which the Turkish boats replied feebly. The *Takat* steered north followed by three destroyers, while the *Anatalia* steered south chased by two destroyers. The *Takat* was hit 15 times and on fire, she ran on the beach near Nikopolis and was totally destroyed. Her commander and 8 men were killed or drowned. The *Anatalia* escaped to Prevesa uninjured. The Italian destroyers were not damaged in this action. They fired 100 shots from 7.6 cm. guns.

September 30 the Italian destroyers *Artigliere* and *Corazziere* attacked the Turkish torpedo-boats *Alpagot* and *Hamid-Abad* lying at anchor at Prevesa, and sank them. An officer from the *Corazziere* having landed the night before had definitely ascertained their positions. The Turkish crew, excepting one man, escaped. The destroyers then entered the harbor. The mob on shore fired on the *Corazziere* as she proceeded to take the steam yacht *Tetied* out. The *Corazziere* fired at the mob and both destroyers left with the steam yacht in tow.

The fort at Prevesa is an old stone fort built during the Venetian period, but armed with 20 modern field guns and five 6-inch Krupp guns. This fort did not fire on the Italians, though the

latter fired 76 shells during the engagement that lasted 45 minutes. The garrison was surprised.

This gave rise to exaggerated rumors of attack and landing of Italians at Prevesa, which the Italian government denied and repeated the orders to avoid landing on any Turkish territory in Europe. The Duke of Abruzzia was directed to revoke his threat of a bombardment of Prevesa within 24 hours, on October 3, if the gunboat and two torpedo-boats in Prevesa were not delivered to him. At the request of the Austrian government the Italians recalled the Duke of Abruzzia with all the Italian ships from that coast.

October 5 a motor boat of the destroyer *Artigliere*, that had been searching an Austrian mail steamer in the harbor of San Giovanni, was fired on by some field guns in an earthwork at that place. The *Artigliere* had not yet received the orders to return to Tarento and she opened fire on the earthwork, and in the course of 45 minutes expended all her ammunition. She silenced the fort and injured a number of buildings in the city. The *Artigliere* was slightly damaged and her commander was wounded. In the meanwhile the *Carabiniere* arrived and opened fire on the earthworks, and left after firing for a period of 20 minutes. After these events the Italian government again declared that every possible precaution should be taken hereafter to avoid all warlike operations in the Adriatic sea.

October 7 the Duke of Abruzzia's squadron again proceeded to blockade the Turkish torpedo-boats in their ports on the Albanian coast.

EVENTS IN THE AEGEAN SEA.

The Italians sent but small naval forces to the Aegean sea, chiefly scouting torpedo vessels. September 30 a panic was created at Smyrna, Salonica and Mythelene by the appearance of passing Italian warships. Probably the *Victoria-Emanuele, Roma* and *Pisa* on a cruise, searching for the Turkish practice squadron.

In Constantinople fears were entertained for the safety of the Turkish practice squadron that had sailed from Beirut at 10 a. m., September 28, for the Dardanelles. This squadron was composed of 2 battleships, 2 cruisers, 9 destroyers and a torpedo-boat mothership. They had no knowledge of war having been declared. The squadron steamed at economical speed to the south-

west coast of Cyprus, practicing evolutions en route. Near the island of Kos, at 4 p. m., October 1, a Turkish government steamer informed them of the war. The British officers in the squadron then decided to remain on board until their arrival at the Dardanelles. The squadron then proceeded at full speed between Mythelene and the mainland, and safely anchored at Nagara in the Dardanelles that evening.

Vice-Admiral Williams of the British navy and other British officers left the squadron. On October 4 the squadron made a short cruise out of the Dardanelles but returned the next day, and anchored off Constantinople and remained there until October 16, In the meantime the harbors of Salonica, Smyrna, Beirut, and the approaches to the Dardanelles were mined. Single Italian cruisers were seen in the Aegean sea on October 4 and 6. Three Italian destroyers appeared off Mythelene on October 15.

THE TRANSPORTATION OF THE ITALIAN EXPEDITION CORPS.

The Italian Navy Department collected 60 steamers of 1300 to 9200 gross tonnage at Naples, Palermo and Genoa. A naval officer was in command of each transport with 25 sailors of the navy. Those transports that were subventioned as auxiliaries for war were armed. All the details of embarkation, loading, and routes for the single transports or in a fleet were successfully kept a profound secret. The expedition corps was divided into two divisions. The first division was sent to Tripoli and the second to the ports of Cyrenaica.

The van sailed in five transports from Genoa, via Naples, on October 6 for Tobruk with some troops and material of the second division, and arrived October 10.

October 9, transports sailed from different Italian ports. 12 transports with the staff of the expeditionary corps and the first division with nine additional transports sailed from Palermo for Tripoli. Within Italian waters the fleet steamed in single column of vessels, with cruisers and torpedo boats ahead and on the flanks. After leaving the Sicilian coast they formed double column, and in two groups, the one with 19 transports and the second group of 14 transports. Speed was 10 knots. Two battleships and several destroyers were in the van, and likewise two battleships in the rear with more torpedo destroyers.

Destroyers also were disposed to form a chain of outposts

along the course between Tripoli and Augusta, the naval base. The first squadron was stationed in the passages from the Aegean sea to the Mediterranean to prevent any interference by the enemy's squadron. The naval commander-in-chief was, at the departure of the convoy, at Augusta.

Good weather was experienced and the first group arrived at Tripoli October 12; the second group arrived October 15. These were preceded by the *Varese* convoying two transports and a hospital ship.

The disembarking was accomplished by means of the ships boats with a large number of large fishing smacks from the island of Lampedusa. The landing proceeded at Tripoli without interruption. The troops from the first group were all landed by October 15, and those of the second group by October 18, a total of 20,000 men being landed from the two groups.

Immediately upon landing the army took the positions held by the naval landing parties, and especially the entrenchments at the 14 wells of Bu Meliana, which had been the repeated object of attack by the Turks. The engineers immediately began work on building entrenchments around the city. The army was promptly engaged with the Turks who made night attacks on Bu Meliana on October 15, 16 and 18, both sides suffering losses in killed and wounded.

October 13, 20 transports sailed from Naples with the second division, about 9000 men, and arrived at Benghasi October 18, having experienced bad weather on the passage. This convoy was escorted by four battleships of the first division, three cruisers, one destroyer and the two seagoing torpedo-boat divisions. They landed at Benghasi, after overcoming the weak resistance of the Turks, on October 19. This group was followed by transports that left Naples between October 15 and 20 with the rest of the Second Infantry Division, about 6000 men. With these the transportation of the expedition corps was practically completed.

(CONTINUED IN NEXT ISSUE.)

DISCUSSION.

Inspection Duty at Navy Yards.

COMMANDER A. B. HOFF, U. S. Navy.—There are two things that strike one forcibly in Lieut.-Commander Parker's article. The first is that he presents in a clear and altogether readable form, every detail of what an inspection officer's duties should be, if carried to their logical limits under the present arrangements. The second is, to my mind, that the Admirable Crichton does not exist with the expert knowledge these arrangements demand.

In saying this I do not say an inspection system is not needed, because it is obvious that it *is* needed. I refer merely to the present arrangements for that work, with an eager hope that the problem may be solved to the betterment of the fleet.

The Inspection Department has been created for efficiency. Efficiency is the best work necessary (not better than is necessary), for the least money. I believe no one will deny that this system has increased efficiency. There remains, therefore, the task of further increasing it. To do this a stimulus has to be provided. Shall the stimulus proceed from without or from within?

Thus far, in the navy, there have been numerous examples of both kinds, but the best have been, and undoubtedly will be, those proceeding from within. I may cite the cases of our tremendous strides in gunnery, in engineering, in the economical use of stores, and in self-maintenance of ships.

The difficulties to be met, in applying such methods to increasing our navy yard efficiency, are apparent to any naval officer.

To mention a few—civilian workmen, difficulty of comparison in cost, and even in excellence of work, due to difference of labor market, climatic conditions, supply of material and industrial conditions, and temporary conditions in the distribution and immediate necessities of the fleet.

As a beginning the present inspection officer and his staff are the result. It is only fair to suppose that modification and progress will take place in this system, and that all are desirous of that result. Otherwise discussion would be out of place.

There is no doubt that this beginning has been pregnant of vastly useful results, in that it has turned the minds of those responsible into the desired channels. Our history shows us that when we, in the navy, get thus far, rapid strides in efficiency are not far off.

To come down to details, I submit that it is apparent that inspection should continue as it now is (in principle) for all material for stock, all manufactured and raw material passed into stock, all work done on ships in commission, and all tests for completed machinery and mechanical devices.

Incidentally, let it be noted that the strictures of the essayist on the inspection of work by ships in commission, while undoubtedly well founded,

is not a prevalent condition. Most well-organized ships have a careful and complete system of inspectors and sub-inspectors organized as a permanent part of their ship's organization, with a very complete system of job-order cards, and daily checks as to the degree of completion of work, its character and the workmen employed. Theoretically the inspection officer should not have to worry greatly about ships in commission. His duties in that regard are limited to advice and assistance.

Such being the case, there remain for inspection the means, methods, work, organization, and cost at the different navy yards. Also the questions of survey and appraisal. These latter, while capable of economic improvement, are minor matters compared to those just before mentioned.

How then shall we improve—by inspection—these important means, methods, etc.? Under the present system the "commandant's eyes" are the inspection officer and his staff. Is this the best way or can a better be found? As already stated this system has turned the minds of all navy yard workers—from chiefs of divisions to laborers—into the channels that lead to improvement. This alone justifies its introduction.

This, however, having been done let us ask ourselves if it is a logical condition to subject experts, up to the point of direction in the details of their work, to the criticism of those less expert. I speak of the present, not of what has gone before.

This view (*i. e.* that it *is* logical) is what I understand the essayist to uphold. He advocates a young constructor being put on the inspection officer's staff to criticize the work and methods of the experienced hull division; a young pay officer being put on that staff to criticize the experienced G. S. K.; and young line officers (machinery, electrical, and ordnance) being placed there to criticize the work of those more experienced. And when I say criticize I do not mean merely comment upon, but by the consequences of the system, *direct,* through the commandant, the whole means, methods, organization, and system of navy yard work.

Outside of its military aspect, is this logical?

Why should not the hull and machinery divisions each have their own inspection department, based on the same system as that used on ships and elsewhere in the navy? That is to say, recognize that the head of a division is the most experienced expert in his branch at a navy yard, and that he is the one most eagerly interested in its efficiency as being the one most vitally concerned in its work.

Cap this with a more extensive board for shore inspections, making more detailed and extensive investigations of all general and local navy yard conditions, all with a view—the only view—of co-operation for betterment, and assistance to attain that end.

LIEUT.-COMMANDER W. T. CLUVERIUS, U. S. Navy.—I believe that Lieut.-Commander Parker has correctly expressed the intent and purpose of the naval regulations concerning the inspection of work. The indirect implication of his paper is the necessity of standardization in carrying on the inspection thus comprehended, and when this is achieved I cannot but feel that beneficial results will obtain and be generally appreciated.

The fleet is the thing. This has been realized, and also it is established that the base exists for the fleet. The reference, then, of all work performed at a navy yard is to the ship—a unit of the fleet. The ship must have what she needs in order to maintain maximum efficiency, and the yard must furnish it. The ship, therefore, must know what she needs and to insure this there is provided for her an inspection force of her own.

This force must deal directly with the yard. No matter how excellent the system of management concerned, or how great the desire to have work progress smoothly, friction to a greater or less degree will occur. It may be to the extent only of misunderstanding, or to that of decided objection. The function of the yard inspection force—made up of a personnel which knows what the ship needs, and why, and which also knows what the yard is doing and can do—is to adjust, by explanation, co-operation, or decision, the point at issue, that is, to lubricate.

The ship's inspection force must be a most potent element of any system of management, no matter how scientific or how casual, as long as the ship is the criterion. The yard inspection force, inspecting work directly or indirectly destined for the ship or the ship's welfare, must be the co-ordinator. A centralized, disinterested force of this nature, representing ship and shop, is more useful certainly than is the individual inspecting force of separate shops passing on the results of their own productive labor, with horizon limited as to the completion and application of the work as a finished whole, and of which each shop concerned does only a part. It has been criticized as an overhead in yard operations. It is. And it is a useless overhead if its personnel is inefficient, a defect as readily corrected as determined. It is useless if a single element of bias or favoritism exists, faults naturally more prone in a system in which self-inspection obtains. It is reasonable to expect impartial inspection by a disinterested force. In a commercial plant opposition is expected to arise spasmodically from those doing the work directed against the force which inspects, criticizes and turns down, if need be, the work of their hands, or which recommends any change the effect of which is not personally beneficial. In the naval service such a stand cannot be sanely based, for properly the good of the service and not personal gain is at heart, and the best there is in the yard of workmanship and endeavor is insured to the ship.

If, however, the inspection department succeeds in reducing any of the other numerous overheads always to be encountered in the varieties and class of work of navy yards—manufacture, repairs, and new construction—then the inspection overhead is positive in value and is a gain.

Lieut.-Commander Parker has covered the ground well. This point should be accented, that is, that the value of inspection at once begins to suffer diminution if it delays the progress of work. With a carefully selected and intelligently arranged force the inspection of the work in the majority of yard operations can be made coincident with the work. I refer particularly to the routine inspection covered by an inspection force that has to deal with the output of the purely manufacturing plant. In other words, the inspection notice can be signed when the job order is closed. A ship's inspection force can do this, and more, with less effort than the yard force, for its work is more concentrated and under easy surveillance.

The scope of the work is great and extends to numerous sorts of articles for stock or shipment in connection with the construction of new vessels, to work on vessels in ordinary or belonging to other branches of the service, and to work in connection with the military upkeep of the yard. Just as yard force must cover the entire field of inspection, so must the ship's force. While giving the yard credit for its desire to do good work, no chances can be taken that will allow inferior workmanship in any detail, through oversight or error, to become incorporated in a vessel of the fleet. In addition, time also is of vital consideration, being both a factor of economy and of military necessity.

I hold, then, in a word, that the goal of inspection is the expedition of properly performed work.

The essayist has dealt well with the subject of costs, the analysis of which the inspection department can and should make, and see that the manufacturing department gets the benefit.

To those who have seen inspection departments operating under differing auspices, the need of standardization of their work is obvious. Some of those connected with inspection departments may believe that efforts at standardization will result in limitation of duties or authority. I do not believe that this can happen. Sound judgment will not place limitations on a field not yet fully explored. Just as concentrated effort is productive of the greatest good to the fleet, so concentrated effort will render the positive value of inspection a maximum.

Aviation in the Navy.

CAPTAIN W. I. CHAMBERS, U. S. Navy.—I am much pleased with Assistant Naval Constructor Hunsaker's translation of Lieutenant Lapointe's valuable article on Aviation in the Navy and I hope that more officers will be inspired to do similar work, as foreign technical publications are already rich in valuable aeronautical information of which there is no counterpart in this country.

I am specially impressed by the author's statement regarding aeroplane equilibrium in which he points out that the usual definition is inexact because "a static equilibrium is assumed in place of an actual dynamic equilibrium," that no account is usually taken of the forces of inertia which are "most important." I have endeavored to lay stress upon this feature in an article on hydro-aeroplane flying and to show that careful attention must be paid to it in maneuvering these "heavy load" machines with low centers of gravity.

His remarks about the horizontal rudder, or elevator, were evidently written before the latest improvements which almost invariably point to a rear non-lifting surface to which a rear elevator only is attached.

I agree with him as to the advantages of flexible wings and the possibilities of a satisfactory degree of inherent stability, or rather of inherent recovery of equilibrium, also as to the impossibility of gyroscopic regulators and, in general, as to "automatic stability" or more properly "automatic regulation of equilibrium." But the analogy of operating a sailboat automatically is hardly fair, since a better comparison would be with the auto-

matic control of a submarine or a torpedo, and no one will doubt that there would be advantage in having, at least, a semiautomatic control to assist in steadying the vertical longitudinal oscillations of a submarine while in the submerged condition.

His discussion of the question of monoplane *versus* biplane is altogether admirable, but in regard to the ornithopter I am inclined to think that the efficiency of the motive power necessary for flapping wings would not be as great in comparison with the screw power *in high winds*. It appears to me for this reason that it is only the large birds with soaring ability that are able to negotiate the high winds.

In regard to his statements about the mathematics of propeller design, I cannot express an authoritative opinion from a mathematician's standpoint, but I am sure that my experience thus far, with the theories and demonstrations in this line, bears ample testimony to the accuracy of his statements and it is evident that the only proper understanding can be arrived at from the results of actual experimental analysis at a properly equipped aerodynamic laboratory.

I endorse most emphatically the writer's condemnation of the acrobatic stunts of a certain class of aviators and I have reasons for believing in the probable advent of the internal combustion turbine as a relief from many existing motor difficulties, but I do not agree with the statement that variable speed is of no advantage to an aeroplane motor except for a few moments before landing. For I am greatly impressed by the belief that safety in flight can be practically assured by flying at a standard speed which is between the high and low critical limits and that it is necessary, for safety, to be able to increase or to reduce the speed in maneuvering.

I am quite sure that the majority of our naval officers will agree with this writer on the relative importance of "capital ships" and auxiliaries, and to me no demonstration is necessary to agree as to the future rôle of aeroplanes in the navy except, perhaps, in that of exercising the functions of fire-control. The latter I will admit, however, as soon as soaring flight is made practicable.

I must disagree entirely with the author's view of the hydro-aeroplane for the reason that if aeroplanes are to be of real service they must be kept in more or less constant use for instruction, training and maneuvers. We must be as familiar with them as we are with guns and boats. They must abide with us and we must have the means, therefore, of utilizing nature's best aerodrome, the water, whenever the circumstances permit. I do not intend to convey the impression, however, that the hydroplane attachment must of necessity be carried during long scouting flights. Furthermore, the use of a "garage vessel" would add another of the needless auxiliaries, which, according to his reasoning, should be avoided.

I am in accord with Lieutenant Lapointe in regard to the use of dirigibles, but am inclined to think it would be a mistake to limit the size to such an extent as to restrict their power to rise to an altitude sufficient to make them safe from gun fire. Great improvements in the strength of envelopes and their resistance to solar radiation are in progress, but much remains to be done to perfect a dirigible suitable for naval purposes.

The author's statement regarding the value of an aerodynamic institute or laboratory cannot be overestimated. Such an establishment is of pressing importance and I am very glad to say that such laboratory work in connection with hydroplane models is already progressing satisfactorily at the Naval Model Basin.

Absence Over Leave in the Fleet.

(SEE No. 140.)

CAPTAIN HUGH RODMAN, U. S. Navy.—A letter to the Department:

U. S. S. *Cleveland*, Cavite, P. I., May 26, 1910.

SIR: 1. Upon taking command of this vessel about a year ago, I found her to be efficient and clean, and that she had been designated by the Commander-in-Chief as a "Smart Ship"; her crew was happy and contented, and it seemed hard to improve upon the discipline on board.

2. Throughout my command, there have been but few serious offenses, most of the reports being due to rum and liberty breaking, and were made in the first few months after I joined; so steps were taken to put an end to these offenses as far as practicable, and with some degree of success.

3. With this end in view, the crew was informed that every opportunity would be taken to grant first class men as much liberty as possible, but that those who showed themselves to be rum-soaks and liberty-breakers would be punished to the full extent of the law. After this plan had been carried out for a few months, a number of the worst offenders were called to the mast in a body, both courses which they might take were fully explained to them, and without exacting any pledges or promises, they were asked to choose the one which they preferred to follow; namely, to continue to violate the regulations and to take the consequences, or to turn over a new leaf and receive the benefits thereof.

4. It was explained that if they chose the latter, they would be given a chance, and would be put on probation until they had a fair trial; that furthermore, they would understand that not only was each individual to behave, but he would use his influence to induce others to do so; that offenses coming under their observation were not to be reported, but that the offenders were to be induced, if possible, to mend their ways, and if they found men under the influence of liquor ashore, that they were to be kept from drinking more, or if inclined to overstay liberty, that they would use every effort to induce them to return to the ship on time. No wholesale immunity was granted; from time to time, other offenders requested permission to go on probation; the officers and petty officers coöperated, and in fact the whole crew have, and the plan has succeeded admirably.

5. My promise has been made good, there is practically a free gangway to special first class men, so far as the regulations allow, and not only is no opportunity neglected to give liberty, but the men are encouraged to go as often as possible.

6. Out of all who were put on probation, there have been but two backsliders, and many of the worst offenders have become special first class; and, in my opinion, the result has been largely accomplished by treating the men

as men, by talking to them firmly but kindly, by analyzing each individual case, punishing when necessary, and by encouragement where it would seem best, and by putting the men on their metal, honor, and pride, and by recognizing these qualities in them, when they have made good.

7. When a punishment is awarded, it is well as far as practicable, to have a uniform standard of punishments for offenses, but it is a mistake to punish for every offense, and a greater one to treat all men alike; many a man has kept his enlistment record clear by being admonished, warned, or put on probation, and by explaining to him the advisability of behaving himself. Some are best approached by kindness, others need a few severe punishments to bring them to their senses; under ordinary circumstances I believe the best results are obtained by trying to analyze each individual character, and if there be any doubt whatever about the best course to pursue, to then think the matter over for twenty-four hours before acting. Above all, avoid hasty conclusions, and be sure that no innocent man is punished. Men who have clear records should be given more consideration than those who continually violate the regulations; many a good man commits a serious offense in a fit of anger, and while still angry, is inclined to be stubborn and obstreperous, who, if given time to cool down and think over the error of his ways, may make amends by apologies and profit by any leniency that may be shown him.

8. Again I believe much discontent amongst the crew is caused by punishing the whole crew for the offenses of a few; for instance, if certain members of the crew get drunk and create a disturbance on shore, and it is impossible to apprehend the guilty parties, I believe it to be a most serious mistake to stop the liberty of the whole ship's company, on this account, or until the guilty parties are apprehended.

9. Petty punishments, for trivial offenses, which are so often awarded, and poorly carried out, have been generally avoided; serious offenses deserving punishments have been awarded severe ones rather than otherwise, and these have been carried out to the letter.

10. A commanding officer cannot be too careful in sizing up the officers under him, in their dealings with the crew, and in noting and correcting individual characteristics which nag and humiliate the men. We have all noted that some officers are liked, some disliked, that some make a great number of reports, others very few, that some perform their duty smoothly, and without trouble, while others seem to meet numerous stumbling-blocks; all of this should be noted and duly weighed by the commanding officer, and steps be taken to immediately correct when necessary, and to point out to the officers concerned the proper course to pursue. Firmness and perfect fairness, seasoned with some of the milk of human kindness, will greatly leaven discipline, and serve to make a happy ship.

11. No opportunity has been lost to add to the comfort of the crew; at stated times committees regularly appointed can make requests and suggestions, in regard to the general mess, or matters relating to the pleasures or comforts of the crew.

12. Every effort has been made to encourage the men to take a pride in the ship, and to make it as much of a home for themselves as possible, and

I believe that she is not only a happy ship, but that the discipline compares favorably with that of any other in the service.

13. In conclusion, it can be stated positively, that offenses that deserved punishments have not been condoned; had this been the case the result would have been far different. There have been no cases of rum or drunkenness on board ship for six months, and the only signs of it have been seen in a few men returning from liberty; liberty-breaking has practically stopped, and it is considerably less than 1% of those who go on leave; to-day 92% of the men are special first class, 2% first class, and only 6% are classed, and these are mostly men who have recently been transferred from other vessels.

The True Story of the America.

(SEE No. 126.)

MR. WILLIAM BARRY MEANY, M. D.—The Continental Ship *America*.—My attention was recently called to an article which appeared in Vol. 34, No. 126, June, 1908, of the United States Naval Institute Proceedings, under caption, "The True Story of the *America*," by Robert W. Neeser.

The leading or key-note paragraph (first paragraph, p. 574) of the article, pp. 573 to 580, both inclusive—and wherein no mention of, or any reference to, the name of Commodore John Barry appears—reads:

"No mention of the *America* * is again made in official documents until June 23, 1779, when Congress authorized Robert Morris to take measures for the speedily launching and equipping for sea the *America*, then on the stocks at Portsmouth, N. H., and three days later, by unanimous resolution, appointed John Paul Jones to command her."

If Mr. Neeser's dates of June 23, 1779, and his "three days later" (June 26, 1779) be corrected to read June 23, 1781, and June 26, 1781, respectively, they would only further accentuate the mistake.

The following letters are copies made by the writer from the official documents of the Continental Marine Committee, on file in the manuscript rooms of the Library of Congress, Washington, D. C.

"Nov. 6, 1779.

"Captain John Barry.

"SIR: As you have been appointed to command a new continental ship (the *America*) that is now on the stocks at Portsmouth in New Hampshire, you are hereby directed to repair to that place and hasten as much as may be in your power the completing of that ship, which we are desirous to have done with all possible despatch. We have now communicated our desire on that head to the Honorable, the Navy Board at Boston, whom you will please to call on in your way and receive such orders as they may think proper to give you.

"Should Mr. Langdon and you agree that any alteration can be made in this ship that will render her more suitable than the present design, you will please to communicate your plan and a state of the ship, which we will consider."

* From about Nov. 9, 1776. See page 573.—W. B. M.

"Nov. 20, 1779.

"Captain John Barry.

"SIR: Agreeable to your desire, we have appointed Captain George Jerry Osborne to command the marines on board your ship, but as it will be a considerable time before there is occasion to raise his men, we have been so early in his appointment on the principle of his being useful in doing matters relative to the ship (the *America*) until that time, you will please to observe and employ him occasionally in such business as you may think proper."

Joseph Dennie (editor of the *Portfolio*), in his biographical sketch of John Barry as it appeared in the *Portfolio* (Philadelphia), July 13, 1813, wrote:

"Having made several voyages to the West Indies in letters of marque vessels, he (Barry) was afterward ordered to take command of a 74 gun ship building in New Hampshire."

It is in order here to state that, owing to the lack of funds to carry on the construction and to complete this new ship of 74 guns, with the considerable time required for its construction, Captain Barry was appointed to take command of the *Alliance*, and to prepare her for a voyage, to carry our envoys, Colonel Laurens and suite, on an important embassy to the French court. When this new ship of 74 guns (the *America*) was completed, at a much later period, about Nov. 5, 1782, Congress had concluded to present her to the King of France.

Barry safely landed his passengers on the *Alliance* in France, and Colonel Laurens succeeded in securing six million livres (gold) from the French King. For details of this voyage etc., see pp. 23, 46, 47, 57 and 62, of my book, "Commodore John Barry"—Meany (Harpers).

In the Journals of Congress (on file at the Library of Congress, Washington, D. C.), June 23, 1781, page 135, the following appears:

"A committee consisting of Mr. Clymer, Mr. Sullivan, Mr. Mathews, to whom were referred two letters of 22d, from Robert Morris, delivered in a report; whereupon: Resolved, That Robert Morris, esquire, be, and is hereby, authorized and directed to take measures for the speedily launching and equipping for sea the ship *America*, now on the stocks at Portsmouth, New Hampshire; That the board of Admiralty be, and they are hereby, directed to assign Mr. Robert Morris the proceeds of the share of the United States in the prizes taken by Captain Barry, to enable Mr. Morris to carry into execution the preceding resolution; That Congress proceed on Tuesday next to the appointment of a commander to the said ship *America*."

On Tuesday June 26, 1781, page 135, appears: "Congress proceeded to the appointment of a captain to the command of the ship *America;* and the ballots being taken, John Paul Jones, esquire, was unanimously elected."

In the Journals of Congress, Sept. 3, 1782: "On motion of Mr. Osgood and seconded by Mr. Williamson—Whereas, the *Magnifique*, a seventy-four gun ship, belonging to the fleet of His Most Christian Majesty, commanded by the Marquis de Vandreuil, has been lately lost by accident in the harbour of Boston, Congress are desirous of testifying on this occasion to his

Majesty, the sense they entertain of his generous exertions on behalf of the United States: Resolved, that the agent of marine be and is hereby instructed to present the *America*, a seventy-four gun ship, in the name of the United States, to Chevalier de la Luzerne for the services of His Most Christian Majesty."

On or about Nov. 5, 1782, the *America* was safely launched under the supervision of the gallant John Paul Jones—who from June 26, 1781 (or shortly afterward), had charge of her construction and completion.

A few days after the *America* was floated she was turned over to the French Admiral, and when fully equipped for sea, she sailed for France.

It is stated that, after two or three years in the French service, she was condemned; her timbers were found to have rotted, owing, it is said, to the unsuitable or to the unseasoned wood used in her construction.

PROFESSIONAL NOTES.

Prepared by LIEUT.-COMMANDER RALPH EARLE, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINE REPUBLIC.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Rivadavia	28,000	Fore River Shipbl'dg Co.	Launched Aug. 26, 1911.
Moreno	28,000	New York "	" Sept. 23, 1911.

The Argentine Republic Minister of Public Works has signed a contract for the construction of a drydock at Puerto Belgrano capable of holding the large battleships now being constructed in the United States for government of Argentina. The cost will reach $6,369,000, and the work is to be completed in three and one-half years, meeting the rapidly increasing demands for docking facilities for naval and mercantile vessels.—*International Marine Engineering.*

AUSTRIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Radetsky	14,500	Trieste.	Under trial.
Zrinyi	14,500	"	Launched April 12, 1910.
Erzherzog Franz Ferdinand.	14,500	"	Under trial.
Viribus Unitis	20,000	"	Launched June 24, 1911.
Tegetthof	20,000	"	Launched March 21, 1912.
VI	20,000	"	Authorized.
VII	20,000	Fiume.	"

THE "TEGETTHOFF."—This vessel is of 20,040 tons displacement, 525 to 495 feet long (authorities differ within these limits), 89 feet beam, having a draft of 26 feet. Her main armor belt is 15 feet wide and 11 inches in thickness at the central part on water-line, tapering to 8 inches above and to 4 inches at ends. The barbettes and gun hoods are of 11-inch armor. The armament is twelve 12-inch guns mounted in four triple gun turrets, the guns of No. 2 and No. 3 turrets firing over the guns of Nos. 1 and 4 respectively. There are twenty-four 4-inch guns mounted in a central battery behind armor. There are four submerged torpedo-tubes. Horsepower is 50,000, to give a speed of 23 knots. Parsons' turbines and Yarrow boilers are fitted. Bullivant torpedo-nets are provided.

The old casemate ship, the *Tegetthoff*, was renamed the *Mars*.

SCOUTS.—The three scouts of the building program are of the *Admiral Spaun* class improved, with engines of 25,000 horse-power as compared with 21,000, and designed speed at 27 knots. They will mount nine 4.7-inch guns and two smaller. The six destroyers, which are also to be built at Fiume, are to be 800-ton vessels, with engines of 17,000 horse-power, and estimated speed of 32.5 knots. The twelve sea-going torpedo-boats are to travel at 28 knots.—*Army and Navy Gazette.*

PROGRESS IN 1911.—The wrecking steamer *Hercules* was completed as was also a special ship for submarines. A floating dock with a capacity for 22,500 tons was completed.

The navy is devoting attention to aviation and a military-naval aviation station has been established at Pola. Owing to the war between Italy and Turkey the Austrian fleet was kept fully manned during latter part of 1911. —*Marine Rundschau.*

SUBMARINES.—The submarines are of Lake type and will be furnished with benzol motors, and this fuel will be superseded by petrol in future submarines.

FLOATING CRANE.—A floating crane provided with long arm to serve for raising submarines is being built at Pola for the Austrian Navy. This crane is fitted to grapple a submarine at a depth of 50 meters, and raise the boat until her conning-tower is above water or one of its ends are on the surface.—*Marine Rundschau.*

PERSONNEL CHANGES.—The Austrian Navy contemplates introducing a new rank between that of Korvettencapitan (lieutenant-commander), and Linienschiffscapitan (lieutenant), and the new rank will be Kapitanleutnant which corresponds in title and grade with the same rank in German Navy and is the same as U. S. naval rank of lieutenant, but hitherto the Austrian rank of battleship-lieutenant was regarded as equal to the rank of Kapitanleutnant (lieutenant U. S. Navy).—*Marine Rundschau.*

BRAZIL.

M. Geraes	(2)	19,250	23,500 = 21	12 12-inch, 50 cal. 22 4.7 inch.	8,500
Rio de Janiero.....	(1)	28,000	= 22	14 12-inch, 50 cal. 20 6-inch, 12 12 pr.	11,900

CHILI.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Constitucion.....	27,500	Elswick.	Laid down Nov. 1911.
Libertad	27,500	Vickers.	" " Dec. 1911.

BATTLESHIPS.—These are to be 625 feet long, to carry 3500 tons of coal and 450 tons of oil fuel.

The new Chilian naval engineering school at Talcahuano is to be completed in time for the opening of the school year in March of this year. It will be equipped for 200 cadets, but only 150 are to be admitted for the present.—*Shipping*, Illustrated.

FRANCE.

VESSELS BUILDING.

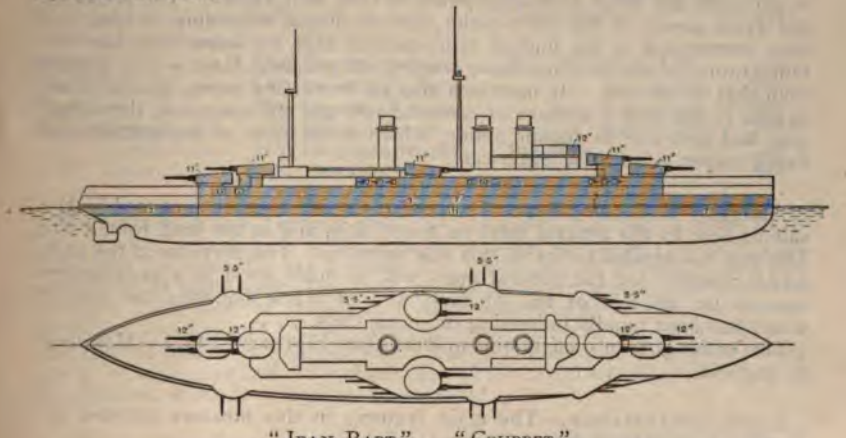
Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Courbet	23,500	Lorient.	Launched Sept. 23, 1911.
Jean Bart	23,500	Brest	" Sept. 22, 1911.
France	23,500	St. Nazaire.	Building.
Paris	23,500	La Seyne.	"
Bretagne.....	25,000	Brest.	Authorized.
Provence	25,000	Lorient.	"
Lorraine	25,000	A private firm.	"

THE 1912 PROGRAM.—This contains three battleships—instead of two as predicted, one replacing the *Liberté*—to be placed on stocks this year; and

includes the building of ten other battleships spread over five years. One of these battleships, the *Lorraine*, will be built in a private ship yard, and if this experiment is successful other vessels will be built by private yards. The law provides that in January, 1920, there will be finished 28 battleships, 10 scout cruisers, 52 destroyers, 10 foreign service ships, 95 submarines, 4 mining vessels, and various auxiliaries. Battleships are to be laid down as follows: three in 1912, two in 1913, two in 1914, four in 1915, and two in 1917.

The expenditure authorized is $281,000,000 during eight years for new constructions.

DOCKS.—The French naval program in the matter of docks provides for the present deficiency, as no less than $24,000,000 are, during the next eight years, to be devoted to the construction of twelve docks, capable of receiving 24,000-ton ships. These docks—six in the North and six in the South—will confer important strategic advantages on the French battle fleet, enabling it to transfer its activity from the Mediterranean to the Atlantic and Channel with the certainty to have near at hand adequately equipped arsenals.



"JEAN BART." "COURBET."

Length, 541 feet; 23,096 tons; speed, 20 knots; armament, twelve 12-inch, twenty-two 5.5-inch.

—From *Brassey's Annual.*

The Lorient dock will be difficult of access, and that of Cherbourg will be exposed to bombardment from the high sea, but this reproach cannot be applied to the Brest, Toulon and Bizerta arsenals.—*The Naval and Military Record.*

COMMENT ON PROGRAM.—We have questioned the expediency of this expenditure, but many have criticised the program, because it provides almost exclusively for battleships of the *Dreadnought* class, instead of following the lead of England in the construction of battleship-cruisers. M. Delcassé pointed out that the policy of France was to concentrate her forces in the Mediterranean. Consequently she required powerful units in which speed was not a primary consideration. Flying machines were expected, in a certain measure, to replace scouts and cruisers, and in a closed sea like the Mediterranean heavily armored battleships had a great advantage. Having fallen from the second to the fourth position amongst naval powers, France is determined not to drop farther in the rear. Since M. Delcassé took office a great change has certainly come over the French Navy.—*The Engineer.*

QUADRUPLE TURRET?—The four-gun turret may make its first appearance in the French battleships of 1913. There are three schemes under consideration. One provides sixteen 12-inch in four turrets; the second for twelve 13.4-inch in three turrets; the third for the same in four turrets, two double and two quadruple turrets.—*United Service Magazine.*

BATTLESHIPS.—*Bretagne, Provence,* and *Lorraine* will be 23,500 tons displacement, 541 feet long and 88.56 feet beam. The armament will consist of ten 13.3-inch guns in five turrets in the longitudinal axis of the ship, twenty-four 6-inch guns, and four torpedo-tubes. The speed will be 20 knots with 28,000 horse-power. The complement will be 1000 men.—*Marine Rundschau.*

ULTRA-VIOLET RAYS IN SUBMARINES.—At a recent meeting of the Comparative Pathology Society at Paris, M. Daniel Berthelot brought out the fact that ultra-violet rays could be used for purifying the air in submarine boats. Such rays are produced in great quantities by the quartz mercury vapor lamp and their sterilizing power is now well known. The secret of the great power of the ultra-violet rays is simple, according to him, for they correspond to the highest temperatures that we know. In fact the temperature of the mercury vapor lamp which produces them is even higher than that of the sun. He mentions also an interesting point, that is, if we expose to the rays a mixture of carbonic acid gas and ammonia, they combine and give rise to formic amide, which is the base of protoplasm and living matter.—*Scientific American.*

ABOLITION OF SALE OF BEER.—Because of the inconvenience caused by the sale of beer by the general mess on board ship, and in the land forces, the Minister has decided to forbid this sale hereafter. The decrease in the gain which resulted for the general mess will be made good in a satisfactory manner by the sale of tea, of milk, and of warm boissons the use of which has been rapidly increasing on many ships. . . .

This order goes into effect nine months after February 5, 1912.—*Moniteur de la Flotte.*

NAVAL ORGANIZATION.—The main features in this measure adopted by the French Senate on March 29, 1912, follow:

The fleet has four divisions:

1. The battle fleet, composed of 28 battleships, 10 scouts, 52 sea-going destroyers.
2. The foreign service fleet, as exigences require.
3. Submarine defence fleet. Ninety-four submarines, four mine-carrying and laying vessels, mine sweepers, and torpedo vessels as required.
4. Special service vessels. Three surveying ships, three transports, schoolships and coast-guard vessels.

Battleships built prior to 1906 will be scrapped when 25 years old, those built later when 20 years old; the destroyers and submarines when 17 years old. Vessels to replace these will be built so as to be ready when these are retired. Vessels lost by wreck will be replaced by vessels started as soon as possible thereafter.

The preparedness of divisions follows:

1st division. One-half will be always in full commission.
2d division. All will be ready for service.
3d division. One-half kept ready.
4th division. Will be fixed by Navy Department according to needs.—*Moniteur de la Flotte.*

GERMANY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.	Completion due.
Battleships.				
Oldenburg	22,400	Danzig (Schichau).	Undergoing trials.	1912
Kaiser	24,500	Kiel (Kaiserliche W.).	Launched Mar. 22, 1911.	1912
Friedrich der Grosse	24,500	Hamburg (Vulkan).	" June 10, 1911.	1912
Kaiserin	24,500	Kiel (Howaldt).	" Nov. 11, 1911.	1913
König Albert	24,500	Danzig (Schichau).	" April 27, 1912.	1913
Prince Regent Luitpold	——	Germania Works.	" Feb. 21, 1912	1913
Ersatz K. Friedrich Wilhelm	——	Hamburg (Vulkan).	Building.	1914
" Weissenburg	——	Bremen (Weser).	"	1914
" S	——	Wilhelmshaven.	"	1914
Armored Cruisers.				
Goeben	22,600	H'b'rg (Blohm and Voss).	Launched Mar. 28, 1911.	1912
Seydlitz	25,000	"	" Mar. 30, 1912.	1913
K	25,000	"	Authorized.	1914
Protected Cruisers.				
Breslau	4,500	Stettin (Vulkan).	Launched May 16, 1911.	1912
Magdeburg	4,500	Bremen (Weser).	" May 13, 1911.	1912
Stralsund	4,500	Bremen (Weser).	" Nov. 4, 1911.	1912
Ersatz Strassburg	4,500	Wilhelmshaven.	" Aug. 24, 1911.	1912
" Seeadler	4,500	Germania Works.	Building.	1913
" Geier	4,500	Howaldt.	"	1913

The proposed new German naval law proposes that the German Navy be extended from 58 to 61 big ships, with 40 protected cruisers instead of 38. The new law provides for a battle fleet consisting of a flagship and five squadrons of eight battleships each, 10 first-class cruisers and 30 protected cruisers. The fleet for service in foreign waters is to be composed of 10 first-class cruisers and 10 protected cruisers. Three active squadrons and one reserve squadron, together with a flagship, making in all 33 battleships, are to be kept constantly in commission. Two extra armed cruisers are to be stationed abroad.—*Shipping*, Illustrated.

An increase in the personnel of the German Navy is demanded because of the necessity of having a third squadron in active service since delays in getting the reserves into action would leave the naval strength below requirements.

The increase in the navy personnel of German Navy up to 1920 requires an annual increase of 75 officers including engineers, surgeons and paymasters and 1600 men. This increase in the personnel requires additional expense each year: 1912, about $3,750,000; 1913, about $7,000,000; 1914, about $9,500,000. Reaching maximum annually in 1916 about $11,750,000.—*Marine Rundschau.*

THE "KAISER" CLASS.—Dimensions are: length, 564.3 feet; breadth, 95.15 feet; draft, 27.2 feet; displacement, 24,500 tons; speed to be 21 knots with 25,000 horse-power. They are turbine driven and the first of Germany's big ships to be so.

Armament is ten 12-inch and fourteen 6-inch.

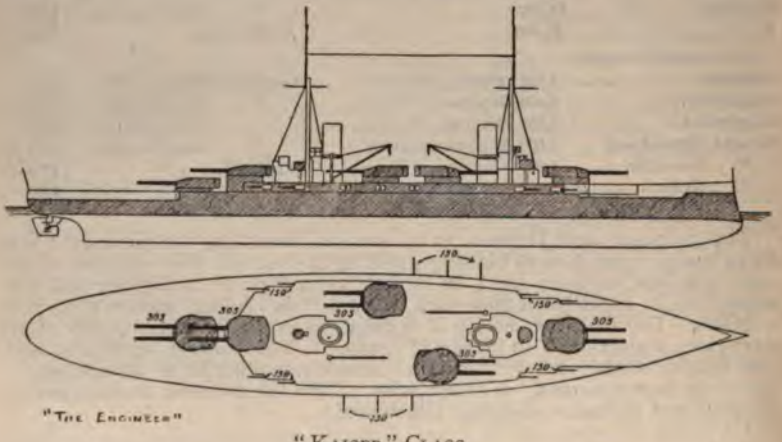
The *Prince Regent Luitpold* will be the first to be armed with 14-inch guns.

The ballistics of the German 12-inch gun, forming the main battery of the *Kaiser* class are said to be superior to those of the corresponding weapon, Mark XI and XII. The life of the new gun is 20 per cent to 25 per cent shorter than that of the 28 cm.—11-inch—gun of the *Nassaus*, and has been

estimated at a maximum of ninety rounds fired without altering the ballistic properties. The weight of each gun position, including armor protection of the turret, is about 550 tons, so that the weight of the main battery amounts to 2750 tons. The weight of the projectile is given at 390 kilos uncapped and 434 kilos with cap. It does not therefore differ much from the weight of the English shell of equal caliber, and is somewhat lighter than the corresponding French projectile.

If strikes do not delay their completion the *Kaiser* and *Friedrich der Grosse* will be ready for trials in the course of this summer, thus slightly reducing the average time of construction of the previous ships.—*Engineer.*

The German battle-cruiser *J*, laid down in 1910, was launched at Hamburg Saturday, March 30, from the yard of Blohm & Voss, and christened the *Seydlitz*. The *Seydlitz* is the fourth vessel of her class in the German Navy. Her length is said to be 558 feet, beam 87 feet, draft 26 feet, and displacement 23,000 tons. Her engines indicate 70,000 horse-power and the agenda speed is 28 knots.—*Shipping*, Illustrated.



"KAISER" CLASS.

"MOLTKE."—The corrected official speed of this vessel is given as 28.4 knots.

NEW SUBMARINE FLOTILLAS.—According to reports from Kiel, a second submarine flotilla will be ready for service next autumn, giving a total of twenty-four such vessels for the German Navy. As at least another flotilla is under construction, and a fourth projected, it is evident that Germany is now determined to make up for lost time, and to equip herself with a numerous fleet of these under-water torpedo craft. In the course of this year the submarine detachment will number 516 men, exclusive of officers, this figure comprising 182 seamen and 334 machinists. The training these men undergo is particularly careful and practical. At the submarine school through which each man passes before he is allowed to serve in the flotilla there is a full-size model of the interior of a submarine, with every engine and appliance in place just as in the boat itself. By this means the men become perfectly familiar with their duties, and may be said to have a good working knowledge of a modern submarine before ever they step on board. Special attention is given to the use of rescue appliances, the men being instructed as to their duty in every possible contingency. In the flotilla itself realistic experiments in the locating and raising of a sunken submarine are

constantly practised with the aid of the parent ship *Vulkan*. When a detachment of boats is permanently stationed at Wilhelmshaven or Cuxhaven, which will be when the second flotilla is ready, it is proposed to institute longer and more arduous cruises than have yet been undertaken for the purpose of accustoming the crews to deep-sea operations under conditions closely resembling those of war. The future distribution of submarines when four flotillas are available will probably be as follows: Two flotillas at North Sea ports, one at Kiel, and one in reserve, but ready at a few hours' notice to reinforce either the Baltic or the North Sea flotillas.—*Naval and Military Record.*

SUBMARINE MANEUVERS.—The maneuvers of these vessels are generally kept a close secret, but we learn that the Kiel flotilla in a thick fog made a cruise from Kiel to Cuxhaven where they arrived in fine shape. The results of this first maneuver of the whole flotilla have been extremely satisfactory according to all reports. The German Navy, which waited such a long time before entering into the construction of submarines, appears now to be very sure of the worth of those she possesses. These, thought in the beginning as arms for defence solely, have now become powerful factors in the offence. The building of those now under way is being pushed so actively that, in the spring of 1912, a second flotilla will be ready for its trials. This flotilla will be attached to the North Sea fleet, its station is not yet fixed.—*La Vie Maritime.*

GERMAN COALING ACHIEVEMENT.—The Berlin correspondent of *The Times* states that the Emperor William has addressed to the commander of the battleship *Helgoland* a Cabinet order which he commands to be read on parade, and then to be framed and glazed, congratulating the commander and the crew on a recent coaling achievement. On February 9 the *Helgoland* took on board 1100 tons of coal in two hours, and achieved a maximum of 671 tons, and an average of 550 tons in the hour. The previous "record" was held by the battleship *Posen*, which took on board 900 tons of coal in one hour 45 minutes, and achieved a maximum of 642 tons, and an average of 514.29 tons in the hour on July 1, 1911.—*Naval and Military Record.*

In March the *Posen* took an average of 602 tons per hour, with 676 as a maximum, and the *Ostfriesland* took an average of 574 tons, with 722 as a maximum.

SOME NAVAL ACCIDENTS.—January 17, 1911. Submarine *U-3* sank in harbor of Kiel, two officers and one man drowned. The *Vulcan* was in dock at the time and reached the scene 12 hours late.

March, 1911. During gunnery practice, the destroyer *D22* received a shell in her stern. No fatalities. A cask of gasolene exploded on board the battleship-cruiser *Yorck*, killing three and wounding two.

April, 1911. The torpedo-boat *S-121* collided with the steamer *Hecla* and was injured so badly that she was out of service for over a month. Two destroyers collided, both suffering great injuries.

August, 1911. During practice at a target, towed by a destroyer, the target was struck by a shell, capsized, and dragged down three men with her. Grave defects were found in the steam piping of the new battleship *Thüringen*, which had to be towed to shipyard for long repairs.

September, 1911. The battleship *Hessen* rammed the Swedish steamer *Akersund* and sunk her.

October, 1911. The same battleship was rammed by the Danish steamer *Argo* and injured badly.

The small cruiser *München* sank a launch carrying sailors, drowning seven.

November, 1911. A 6-inch charge exploded on board the battleship *Thüringen;* five men seriously wounded.

A torpedo-boat *S-167* was rammed by a Dutch tug and injured seriously.

March 25, 1912. The German battleship *Elsass* collided with and sank the Swedish coasting steamer *Pollux* in the Skagerda between Norway and Jutland March 23. The crew of the *Pollux* was rescued.

GREAT BRITAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Conqueror	22,500	Beardmore.	Launched May 1, 1911.
Thunderer	22,500	London (Thames Iron Works).	Under trial.
Ajax	23,500	Scotts (Greenock).	Launched March 21, 1912.
Audacious	23,500	Cammell, Laird & Co.	Building.
Centurion	23,500	Devonport.	Launched Nov. 18, 1911.
King George V	23,500	Portsmouth.	" Oct. 9, 1911.
Centurion	25,000	"	Building.
Queen Mary	28,850	Devonport.	Launched March 20, 1912.
Benbow	.....	Beardmore.	Ordered.
Delhi	.....	Vickers.	"
Iron Duke	.....	Portsmouth.	"
Marlborough	.....	Devonport.	"
Armored Cruisers.			
Princess Royal	26,350	Vickers.	Launched Apr. 29, 1911.
Australia	18,800	Brown & Co.	" Oct. 25, 1911.
New Zealand	18,800	Fairfield.	" July 1, 1911.
Queen Mary	26,850	Palmer (Jarrow).	Launched March 20, 1912.
Tiger	28,000	Brown & Co.	Building.
Cruisers.			
Amphion	3,400	Pembroke.	Launched Dec. 4, 1911.
Southampton	5,400	Brown & Co.	Building.
Dublin	5,400	Beardmore.	Launched April 30, 1912.
Sydney	5,400	London & Glasgow Co.	Building.
Chatham	5,400	Chatham.	Launched Nov. 9, 1911.
Melbourne	5,400	Cammell, Laird & Co.	Building.
1	5,700	.....	.....
2	5,700	.....	.....
3	5,700	.....	.....

THE NAVY ESTIMATES.—The navy estimates provide for an expenditure during the year ending with March, 1913, of $213,814,190, and for the laying down of four large armored ships, eight light armored cruisers, twenty destroyers, together with a number of submarines and subsidiary craft. In the case of the four large armored ships to be laid down comparatively little progress will be made. They will not be commenced until an advanced date in the year, so that the expenditure on them in the year's estimates will be small. Twenty destroyers are to be commenced at once.

A special feature of the new program is the eight "light armored cruisers." This, we understand, is to be an entirely new class. The first desideratum in the new vessels will be speed, in order that they may serve as "eyes" to squadrons of battle-cruisers capable of maintaining a fleet speed of 28 knots. Obviously the new vessels must live in the same heavy seas and excel this speed. They will be armored so as to be indifferent to attack by destroyers; in other words, to live through such contact as requires the piercing of the fringe of the screen of an enemy's fleet, in order to ascertain the strength of the screen itself. The armament will be a tertiary consideration, as their firing will be purely defensive, and confined to such actions as are necessary to get and deliver information to the heavier fighting ships of their fleet.

The twenty destroyers will be ordered before March is ended, and the submarines later in the year. Among the new auxiliaries provided for are several vessels for conveying oil fuel to the fleet; throughout the estimates there are various suggestions of the extension of the use of this fuel. Thus on oil storage $630,500 is being spent at Chatham, $37,345 at Haulbowline, $121,250 at Hong Kong, $582,000 at the Humber, $213,400 at Invergordon on the Cromarty Firth, $64,505 at Pembroke, $121,500 at Portland, and $222,500 at Portsmouth; in some cases, as in the last two cases, the works in progress are in addition to existing provision. In all these cases substantial contributions are made under the estimates for progress with this work during the next year.

The total for new ship construction is $68,041,536.—*Engineering.*

On April 1, 1912, there are under construction: 10 battleships, 6 battle-cruisers (including one each for the Commonwealth of Australia and the Dominion of New Zealand), 8 second-class protected cruisers (including 2 for the Commonwealth of Australia), 2 unarmored cruisers, 31 torpedo-boat destroyers, 15 submarines (including 2 for the Commonwealth of Australia), 2 river gunboats.—*The Engineer.*

DRY DOCKS.—The docking accommodation available for the fleet, actual and prospective, is not unsatisfactory. Indeed, I may say I was very agreeably surprised by an inquiry I undertook into it. We possess at the present time nine docks which can take *Invincibles, Lord Nelsons,* and all earlier ships; and five of these are suitable for our latest battleships. In a few months there will be two floating docks capable of taking the largest size of ships which exist at present, and these two floating docks will be put, one in the Medway and the other ultimately at Portsmouth. Early next year there will be a new dock ready at Portsmouth, another also of the largest size will be ready in January, 1914. In 1916 the three docks and the lock at Rosyth—four in all—will be available. Meanwhile, there are five private docks we have in view to dock the largest vessel, and two others now in course of construction. In addition to the above, there are four others which will take in vessels of the *Invincible* class. That is, in the opinion of the Admiralty, sufficient provision for our needs at the present time. It is suggested that pending the completion of the docks at Rosyth, one of our floating docks when ready should be towed to Cromarty and used there as a subsidiary base with floating workshops. Further provision for docks will be necessary in 1916 or before 1920, for we have to look four years ahead in regard to docks. But there is no cause for anxiety or complaint in the immediate future.—*The Engineer.*

THE "AJAX."—Length, 555 feet; beam, 89.5 feet; draft, 27.5 feet. She carries ten 13.5-inch guns, sixteen 4.7-inch, and has three submarine tubes. The main battery is located in five turrets on the center line. The armored deck is 2.8 inches, and the belt is 12.2 inches, extending for two-thirds of her length. The two lower strakes are 12 inches, the one above that is 9 inches, and above that is 8 inches. Forward and aft of this tapering armor extends to bow and stern. Has Parsons' turbines fitted to run four screws. Trial speed to be 21 knots with 31,000 horse-power.—*Moniteur de la Flotte* and *Naval and Military Record.*

The *Queen Mary* is a sister ship of the *Lion,* described on page 321 of No. 141. She is expected to develop 75,000 horse-power and 30 knots speed.

The battle-cruiser *Tiger,* to be laid down this year, is designed for 87,000 horse-power, 30 knots speed, and will be 700 feet long and 90 feet beam.

STEAM TRIALS OF H. M. S. "THUNDERER."—The battleship *Thunderer* has successfully passed all her steam trials, and will return to the Thames to be completed for commission. This vessel was built by the Thames Iron

Works & Shipbuilding Co., the first keel-plate having been laid on April 13, 1910, and the vessel launched on February 1, 1911. The date for completion is May next. The *Thunderer* is a battleship with a displacement tonnage of 22,500 tons, the length being 545 feet and the beam 88½ feet. She is armed with ten 13.5-inch and twenty-four 4-inch guns, the gun positions being protected by 10-inch armor. The main broadside belt is 12 inches thick, tapering forward and aft to 4 inches, while the upper part on the broadside is protected with 9-inch armor. The boilers are of the Babcock and Wilcox type, and the turbines of the Parsons' design.

The first official trial consisted of a thirty hours run at about 70 per cent of the full designed power. During part of the time, as is usual with such ships, the engines worked with open and closed exhaust, separate results being taken in connection with the design of machinery for future ships. The mean result of the thirty hours run was that the machinery developed 18,927 shaft horse-power, while the average revolutions were 265 per minute. Six runs were made on the measured mile at Polperro, when, with a mean of 17,787 shaft horse-power, a speed of 18.8 knots was realized.

Throughout the eight hours trial at full power the engines ran at an average of 299 revolutions per minute, the mean power developed being 27,416 shaft horse-power, while the coal consumption was 1.78 pound per shaft horse-power per hour. On this run also the ship made six runs over the measured mile, the mean results being: revolutions, 300; shaft horse-power, 27,426; and speed, 20.8 knots. The machinery throughout worked satisfactorily.—*Engineering.*

GUN TRIALS OF "THUNDERER."—The battleship *Thunderer* left Spithead on March 14 for her gun trials; she returned in the evening, and reported that the trials were satisfactory. Her guns were fired first in pairs, gradually increasing the number of simultaneous discharges until the whole broadside was fired, first with half charges and then with full charges. The trials, it is understood, proved satisfactory, the structure of the vessel developing no weakness.—*United Service Gazette.*

ROLLING OF BATTLESHIPS.—The *Monarch* and *Orion* have had their bilge keels removed and replaced by larger ones in the endeavor to counteract their excessive rolling at sea. The *Orion* will also carry out tests with a number of different forms of propellers.—*United Service Gazette.*

"LIONS." ALTERATIONS.—The changes affecting the fire-control, secondary armament, conning-tower, masts and bridge fittings of the battle-cruiser *Lion* are considered likely to have a far-reaching effect on the designs of future *Dreadnoughts.*

Taking the fittings in the order named, the change in the position of the principal range-control instruments from the lofty and exposed platform built around the head of the tripod mast to the conning-tower, which is to be enlarged and raised to accommodate them, is of extreme importance, as it eliminates the risk to which these important instruments would be exposed either by the destruction of the supporting platform itself or the cutting of its electrical communications by shell fire; consequently the fighting efficiency of the *Lion* and her sister vessels will be increased by the armor protection afforded to the instruments, and the superiority thereby gained will be further enhanced by the fact that additional sets of range-finding and control instruments are provided, also behind armor.

The placing of the principal sets of instruments at a lower level may at extreme ranges militate to some extent against the accurate markings of shots, other than direct hits, but this will be provided for by a platform on the new mast for the accommodation of a small "spotting" staff. This change in the position of the principal ranging instruments from an exposed to a protected position has been anticipated in the fleet, where it is welcomed as a distinct gain in efficiency.

Another important change in connection with the *Lion's* armament is the conversion from open unprotected battery positions to enclosed protected casemates for the 4-inch anti-torpedo guns, the *Lion* being the first battle-cruiser in which casemates for these guns are being fitted, thus affording them that protection which naval opinion has called for. This change, together with the alteration to the conning-tower, has necessitated a remodeling of the fore superstructure and the bridge, the effect of which will be an all-round gain in efficiency as effecting the 4-inch armament, searchlight and navigating equipment.

To reduce the ill effects of the highly heated escaping gases from the funnels, it has been decided to considerably increase their height, and this, with a change in their shape and position, will, it is thought, secure the desired result.

Similar alterations will, it is understood, be worked into the *Orion* class almost immediately, and in earlier *Dreadnought* groups as opportunities occur, and will also form part of the equipment of the *King Gorge V* class.—*Naval and Military Record.*

This vessel was to have been commissioned last November, but will not join the fleet till end of May.

DEFECTS IN "LION."—For some unintelligible reason the fire-control mast in these ships is perched as near the forward funnel as possible. The volume of hot gases makes the fire-control platform untenable. It is, therefore, being removed from the mast-head to the conning-tower. The more elevated the control the greater the hitting powers at any range over four miles. By lowering the control station to half its original altitude in the *Lion*, the spotting capacity upon which effective marksmanship depends at long range is minimized greatly. This is very foolish in a type of ship designed originally for long range fighting, with the greatest speed and the heaviest guns to enable her to choose her own tactical position. It should not have been difficult to find a solution to this original error of design without such a serious sacrifice of aggressive precision.—*Shipping*, Illustrated.

The above alterations have been necessitated by the heat from the foremost funnel having been found so great in the course of the official steam trials that when all the boilers were in use it twisted some of the fittings on the navigating bridge, warped the woodwork, and generally made the conditions unbearable for those on duty there. It was also found that the heat from the funnel seriously affected the ship's compasses and other delicate instruments on the bridge and in the fire-control platform which forms part of the tripod mast. The positions of the masts will be reversed, and the foremost of the three funnels will be shifted further aft.

SECOND-CLASS CRUISERS.—There are fifteen of this class now under construction or completed since 1909. The length is 430 feet in all, but the beam has increased from 47 feet to 49.5 feet, draft from 15.25 to 15 feet 10 inches, the displacement rising from 4800 to 5440 tons. The average speed has been 26 knots. They are twin-screw turbine vessels, with I. H. P. of 22,000 to 25,000. Each shaft has independent units for the complete range of steam expansion, from boiler pressure to condenser vacuum. There is an impulse wheel at each high pressure end.

Armament is eight 6-inch guns. Two submerged torpedo-tubes. Their fuel capacity gives a large radius of action.—*Engineering.*

H. M. S. *Attack*, one of the special destroyers with superheaters, built for the British Admiralty by Messrs. Yarrow, of Glasgow, had a very successful official full-speed trial on Saturday, March 30, on the Skelmorlie deep-water-measured mile at the mouth of the Clyde, attaining a mean speed during a continuous run of eight hours of 30.6 knots, thus exceeding the contract speed of 28 knots by 2.6 knots.

The vessel is 240 feet long by 25 feet 7 inches beam, propelled by Brown-Curtis turbines driving twin screws, steam being supplied by three Yarrow water-tube boilers fitted with the firm's most recent superheating and feed-heating devices.

NEW BRITISH DESTROYERS.—The twenty ocean-going destroyers for which tenders have been invited will be of an improved design, the principal characteristics of which will be increased sea-keeping qualities, combined with a superior armament, both gun and torpedo, the power of the latter being doubled. Compared with their immediate predecessors, the *Acorn* and *Acheron* classes, there will be an increase of nearly 50 per cent in displacement, viz., from 780 to 1100 tons; an increase in dimensions from 240 x 25½ to 265 x 27 feet; in armament from two 4-inch and two 12-pounder guns to three 4-inch, while two new design double 21-inch tubes are to take the place of the two single 21-inch now mounted, thus giving an increase of 100 per cent effective torpedo power.

The improvement in torpedo armament is considered of great importance, inasmuch as it will not only double the striking power of each unit, but will also relieve the strain on the storage capacity of the depot ships to a corresponding degree.

In speed and fuel capacity the new vessels will also be superior to their immediate predecessors.—*Naval and Military Record.*

SIZE OF SUBMARINES.—The orders for still larger submarines indicate that there is continued advance in this connection. Indeed, now that it seems certain that the submarine carrying one or more guns in addition to an armament of torpedoes has come to stay, there is a possibility that before long the powers may cease to build destroyers and torpedo-boats and concentrate their energy entirely on under-water craft. The idea of the submarine as a daylight destroyer has been accepted for some time, and surface torpedo craft have therefore come to be mainly associated with night attack and defence. But if, besides being armed with guns, the submarine can be equipped with the high speed and radius of action of the destroyer it may develop into a vessel for night use also, replacing the destroyer in that sphere of work as it has already done for operations by day. At present, however, it is scarcely equal to an ocean-going destroyer in point of size, and considerable progress must still be made before it can be an efficient substitute for the latter in the manner referred to. During the last five years or so the development of British submarine construction has been very rapid. The numerous boats of the "C" class, the construction of which made our relative position as regards submarines unrivalled in the world, were followed by the eight vessels of the "D" class, which were not only larger and better sea-going boats, but in which wireless was introduced, and also guns for offensive use. Next there were begun last year the six boats of the "E" class, which showed an all-round advance on those of the "D" type, and now that the time has come for the 1911-12 boats to be ordered, two have been allotted to Chatham as usual, three to Vickers, and one is to be of a novel type to be built by the Scotts' Company, of Greenock. The design of the last-named is on the plan of the Italian constructor Laurenti, which is understood to include improvements in the design and shape of the vessel.—*The Army and Navy Gazette,* Feb. 10.

THREE SUBMARINE TENDERS.—The submarine tender *Adamant* and her sister the *Alecto,* were both constructed by Cammell, Laird & Co., Limited, of Birkenhead. They are of 935 tons displacement, with a horse-power of 1400. The designed speed is 14 knots.—*Engineer.*

They are fitted with reciprocating engines of 1400 horse-power, which gives them a speed of 14 knots. Internally, she has large accommodation for storing torpedoes, and workshops for carrying out repairs. The sheerlegs fitted aft—of about 5 tons capacity—are to enable torpedoes to

be lifted out of the water, and, on occasion, weights out of the submarine boats in connection with repairs at sea.—*Engineering.*

The submarine is in no way so self-supporting as a big ship. Like the destroyer, her efficiency depends almost, if not entirely, upon a suitable mother ship, which carries the necessary stores and spares. Up till now old gunboats or cruisers have been utilized for this purpose, but such vessels are obviously makeshifts, and in no way to be compared with craft specially designed for the purpose for which it is intended to use them.

The *Adamant* and *Alecto*, which are replete with all the latest requirements for the particular service they were designed for, are intended to replace two of the old warships now extemporized for depot work. Both vessels are to have sheerlegs and a tripod at the stern for towing disabled submarines.

From the Carlsdyke yard of Scott's Shipbuilding & Engineering Co., Greenock, there was launched on April 29 the submarine depot ship *Maidstone*, which, like the two foregoing, has been designed to be a "mother ship" for supplying the needs of submarines during the course of long voyages. She is a vessel of 3600 tons at load draft, and will have propelling machinery of 2800 indicated horse-power. She is to carry stores for a submarine fleet, and, while not intended to undertake long voyages, she will be able probably, with coaling help from a fleet at sea, to obtain a very considerable radius of action.

All the emergency gear which has stood the test of practical everyday use in the old submarine tenders will be embodied in this new "mother ship." Elaborate workrooms, with powerful electric plant, will be a feature of the vessel, and all well-approved means of tackling and lifting submarine craft—strong hawsers and jacks from the side of the vessel—will be provided.—*Engineer.*

THE SALVING OF THE SUBMARINE BOAT "A3."—The damage caused by the collision of the submarine boat *A3* and the gunboat *Hazard* has been proved to be very serious. One of the rudders of the *Hazard* has been found jammed into the conning-tower of the submarine boat, and the injury to the propeller disclosed when the gunboat was docked gives rise to the belief that it acted as a knife to rip the upper shell-plates of the submarine boat. These facts, which are supported by divers' observations, make it quite certain that no air-helmets or other appliances on board could have obviated the loss of life. Moreover, they raise doubt as to the advantage of attempting to salve the vessel.—*Engineering.*

The ill-fated *A3* is one of the earlier types of submarines built for the British Navy, and is now practically obsolete for all purposes except that of coast and harbor defence. She was launched in 1903, and has a displacement of 204 tons with an indicated horse-power of 110 submerged and 450 on the surface, her speed being seven knots below and twelve above.—*Page's Weekly.*

HOSPITAL SHIP.—British Admiralty design contemplates a vessel of 5000 tons displacement, steam turbines, and burn oil. She will be a sea-going hospital with operating rooms, laboratories, and dispensary. There will be various wards. An elaborate communication telephone system is provided. The designing is under direction of Sir James Porter, the medical director general of the navy. It is the first ship ever built in the world for solely hospital purposes. Cost will be $707,500.

NAVAL COALING.—During the recent combined cruise of the second division of the home fleet and the Atlantic fleet, ships coaled from colliers at Arosa Bay, with the following results:

	Tons.	Average per hour.
Colossus	829	355.3
Hercules	875	328.2
Britannia	558	318.9
Agamemnon	616	284.3

Coaling at Portland from lighters, the battleship *Neptune*, flagship of Admiral Sir G. A. Callaghan, took on board 750 tons in 1 hour 30 minutes actual time from the moment the first coal was shovelled into bags in the lighters until the last batch of bags was dropped on the deck. The coaling party went on board the lighters at 10.57 a. m., and at 12.40 p. m. they had returned on board the *Neptune*.

Four lighters were used, two being fitted with Temperley transporters and two with ordinary gear.

Admiral Callaghan has addressed a general message to the crew of the *Neptune* congratulating them upon their smart performance in beating the world's record in coaling from lighters.—*Naval and Military Record.*

GOOD COALING UNDER ADVERSE CONDITIONS.—On the return to Portland of the second division of the home fleet from Torbay preparations were made to complete the ships with coal from the dockyard stock. The coal was transferred to the ships by lighters, except in the case of the *Falmouth* and *Bristol*, which proceeded alongside the coaling jetty. The averages were good when the conditions of coaling are considered. A gale was accompanied by heavy seas, and the coal lighters were continually washed down. Results:

	Tons received.	Average per hour.
Indomitable	1,250	269.5
Bristol	500	210.6
Falmouth	300	209.7
Colossus	980	174.5
Warrior	750	169.8
Hercules	800	168.8
Lord Nelson	880	140.5
Achilles	900	120.2
Britannia	630	78.5

On arrival at Gibraltar we coaled to maximum stowage, in a gale and deluge of rain. Some good results were obtained, the *Triumph* creating a third record in succession, this time having made the highest known average for coaling alongside at Gibraltar. Following are the results:

Ship.	Amount taken in. Tons.	Average. Tons.
Triumph	700	344.26
Swiftsure	890	290.2
Exmouth	950	193.2
Duncan	965	193
Russell	1,017	150.6
Cornwallis	840	148.23

—*The Naval and Military Record.*

COMMISSIONING OF WARRANT OFFICERS.—A real avenue from the mess-deck to the quarter-deck is now to be formed. As the First Lord of the Admiralty has announced, the Board will select from among the younger warrant officers from 25 to 30 annually for advancement to the rank of commissioned warrant officer, and these selected officers, the best possible representatives of the lower deck, will be eligible for further promotion to the ranks of lieutenant and commander. This important change is to be effected for two reasons. Firstly, it will enable the Admiralty to increase more rapidly the number of executive commissioned officers, and, secondly,

the step is designed to satisfy those legitimate aspirations of the fleetmen which have long been supported by this journal. Henceforward commissioned rank in the real sense will be open to the best men of the Royal Navy, and the reform will also tend to stimulate competition for promotion to warrant rank. We are sufficiently in touch with the views of naval warrant officers to be able to say with confidence that both seniors and juniors will unite in welcoming the reform. The seniors will be satisfied to attain promotion to commissioned rank after fifteen years service, and will be content that higher ranks on the active list are to be opened to their juniors. Mr. Churchill's explanation implies that selected warrant officers will enjoy opportunities of reaching the rank of commander on the active list, while a larger number will become lieutenants and commanders on the retired list.—*The Naval and Military Record.*

NAVAL ACCIDENTS.—July, 1911. The sea-going destroyers of the *Acorn* class, about 800 tons displacement, and built especially to keep the sea in all kinds of weather, during the maneuvers of the home fleet, proved so unseaworthy that eight were compelled to give up the exercises and return to port for a long period of repairs.

August, 1911. The Canadian cruiser *Niobe* struck the rocks off Cape Sable, and the English cruiser *Cornwall*, endeavoring to give her assistance, struck near her.

September, 1911. The submarine *A-1*, used for training, sank, fortunately, when no one was aboard.

November, 1911. At target practice the battleship *Hindustan* was struck on her quarter by a shell from the battleship *Colossus*. Some days later the chase of a 3-inch gun blew off on the *Nymph*, destroyer, killing one officer and three men.

December, 1911. The oil in the crank case of a dynamo exploded on the battleship *Orion*, seriously wounding 17 men and 3 officers.

February, 1912. Submarine *A-3* was sunk by her tender, the Hazard, and all on board lost.

May, 1912. The British battleship *Empress of India* was in collision on the second with a German sailing vessel at Spithead. The battleship received a gaping hole in her side above the main deck, while the merchantman lost headgear and foretopmast.

The *Empress of India* was in mid-channel in tow of the cruiser *Warrior* at the time of the crash.

NEW ORGANIZATION OF BRITISH FLEET.—*New Classification.*—The term "division" is restricted to its familiar signal-book meaning as a tactical unit of variable quantity applicable to any part of a body of ships grouped together for tactical purposes. The home fleet and ships are classed in fleets according to the status of the commission in which they are maintained by their lordships, ships in the first fleet being in permament commission with full crews, ships in the second fleet being in commission with nucleus crews and receiving full complements of active service ratings on mobilization, ships in the third fleet being in commission with reduced nucleus crews, or in the "Matériel Reserve" and requiring reserve men on mobilization. These fleets are therefore administrative and not tactical classification.

The home fleet thus divided into three fleets will comprise eight squadrons. Each squadron will consist of a battle squadron and cruiser squadron and attached ships numbered consecutively. Four squadrons will form the first fleet, two the second fleet, and two squadrons and three additional cruiser squadrons the third fleet.

Training Squadron.—The present fourth cruiser squadron will in future be known as the training squadron.

Mediterranean Fleet.—The present sixth cruiser squadron will in future be known as the Mediterranean cruiser squadron.

Eastern Fleet.—This fleet will comprise the China squadron, Australian squadron, East Indies squadron. Other vessels on foreign stations will continue to be designated as at present, but the vessels employed in Newfoundland, the West Indies, and on the southeast coast of South America will, if combined, be known as the west Atlantic squadron.

Flotillas reorganized.—The organization of the destroyer flotillas will conform to the foregoing system. The present first, second, and seventh flotillas will be reorganized into four flotillas, to be known in future as the first, second, third, and fourth flotillas. The present third, fourth, and fifth flotillas (nucleus crews) will be also reorganized into four flotillas, to be known in future as the fifth, sixth, seventh, and eighth flotillas. The vessels composing the present sixth flotilla will in future be included in the home port flotillas.

The first, second, third, and fourth flotillas will in normal circumstances be under the orders of the commander-in-chief of the home fleets. The fifth, sixth, seventh, and eighth flotillas will form the command of a flag officer, styled "Admiral of Patrols." This officer will be under the direct orders of the Admiralty.

The submarine sections in home waters will also, from May 1, be rearranged in nine sections. They will remain under the general control of the inspecting-captain of submarines, who will be responsible to the commander-in-chief of the home ports for those sections where assigned to port defence, and will be responsible to the admiral of patrols for the remainder.—*Naval and Military Record.*

ITALY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Dante Alighieri	19,000	Gov't Yard, Castellamare.	Launched Aug. 20, 1910.
Cavour.	22,000	" " Spezia.	" Aug. 10, 1911.
Giulio Cesare	22,000	Ansaldo-Armstrong.	" Oct. 15, 1911.
Leonardo da Vinci ...	22,000	Genoa (Odero).	" Oct. 14, 1911.
Andrea Dorea	25,000	Spezia.	Building.
Duilio	25,000	Castellamare	"
Scouts.			
Quarto.....	3,400	Venice.	" Aug. 19. 1911.
Marsala	3,400	Castellamare.	" Feb. , 1912.
Nino Bixio.....	3,400	"	" Dec. 28, 1911.

The *Rivista Nautica* states that the Italian Board of Admirals has decided to build super-*Dreadnoughts* of 29,000 tons displacements and 25 knots speed with an armament of ten 14-inch and twenty 6-inch guns. The estimated cost of such a battleship is $18,000,000. The Italian Navy will increase her fighting fleet by 10 *Dreadnoughts* to be laid down in the near future. While the Italian Navy has not yet a single *Dreadnought* in commission there are six building and not yet completed.—*Marine Rundschau.*

DOCKS.—The floating and experimental dock for Italian submarines has been completed by the Fiat Company and a second dock, capable of going to sea with its own power, is being built at the Fiat Company's works at Spezia.—*Marine Rundschau.*

In view of the increased naval problems by the acquisition of Tripoli and Cyrenaica it is contemplated to considerably increase the strength of the Italian Navy and also that of the Austrian Navy that these two navies may be superior to that of France. The two triple alliance countries can at present only oppose a combined force of 17 battleships against 22 French battleships and as the new French program provides for 28 *Dreadnoughts* or super-*Dreadnoughts*, Italy should, in 1920, have an additional 15, and Austria 10 battleships.

The armament of the *Andrea Dorea* and *Duilio* will comprise fifteen 12-inch mounted in five triple turrets. The armor belt will have maximum thickness of 10.5 inches. Their speed will be 23 knots, with horse-power of 38,000. Are 525 feet long, and 88.5 feet beam, drawing 29 feet.

All Italian battleships have Bullivant torpedo-nets.

Italy is building 14 destroyers of 600 tons, two of these will have motor engines.—*Marine Rundschau.*

SUBMERSIBLE BOAT "ATROPO."—This boat was launched on March 22. Her principal dimensions are the following: Length, 146 feet; beam, 14 feet 5 inches; displacement (submerged), 320 tons.

When the boat is run on the surface, her two propellers are driven by two-cycle oil engines of Messrs. Krupp's own type, and aggregating 600 effective horse-power. When submerged, she is driven by two electric motors, as in the case with all submarine boats. The contract speeds are 12.5 and 8 knots respectively on the surface and submerged. Her radius of action on the surface is 1300 miles, and under water 40 miles.—*Engineering.*

AUXILIARY VESSEL.—The Italian cruiser *Giovanni Bausan* is to be converted into a distilling and tank ship.—*Marine Rundschau.*

PERSONNEL NOTES.—New Italian regulations provide that cadets shall enter at ages from 12 to 16, take four years training and education, when they shall be eligible to commissions as officers at ages of from 16 to 20. The old regulations provided for entrance ages of 17 to 19 years.

December 31, Italy had 35,753 men in the navy exclusive of officers. 5830 of these men belong to the different categories of reserves.

During the first nine months of 1911 the Italian Navy was being prepared for the war with Turkey. The most notable feature was in the personnel of officers. Ninety-nine officers, who were inferior in qualifications, were retired from service. Eight of the nine vice-admirals who were on the active list at the beginning of the year were retired, three because of having reached the age limit, and five were compulsorily selected out, leaving the squadron commander "Aubry" the only one in active service.

The recruiting and training of officers has been remodeled according to the British methods. The strictest regulations are being enforced for officers to qualify for promotion and a strenuous system of selecting out has been adopted.

The peace strength of the personnel has been fixed at 28,500 men and active service limited to three years with special rewards for continuous-service men.—*Marine Rundschau.*

NAVAL ACCIDENTS.—February, 1911. While exercising at anchoring mines at Spezia, one exploded prematurely and three men were killed and two wounded.

August 12, 1911. The battleship-cruiser *San Giorgio*, one of the best and most powerful units of the Italian fleet, was badly wrecked on the rocks of Posilippo. She was refloated and left her dock completely repaired and took her place in the squadron on April 2, 1912.

September 18, 1911. The destroyer *Pontiere*, having run aground, was completely wrecked by a hurricane which caught her while in that unfortunate predicament.

SALVAGE OF THE "SAN GIORGIO."—This vessel, while entering the harbor of Naples on August 12, 1911, steaming at 13 knots, ran ashore on Gaiola Shoal off Posilippo Point.

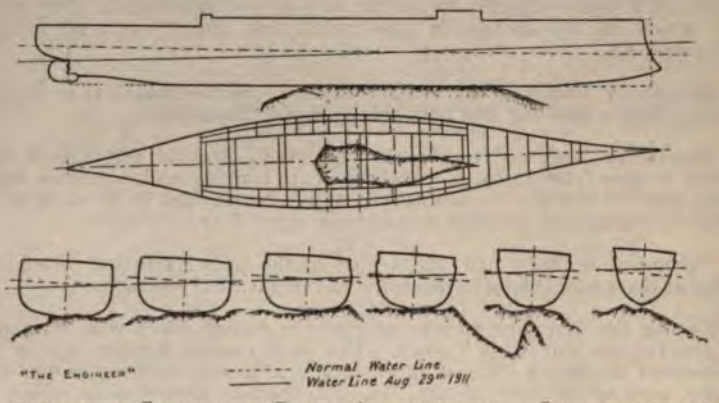
The *San Giorgio* is a four-funnelled armored cruiser completed in 1911, displacing, when she struck, 10,580 tons, 430 feet long, 68.75 feet beam, with speed of 22.5 knots, and armed with four 10-inch, eight 8-inch, and sixteen 3-inch guns.

Water poured into the fore and amidships double bottom and powder magazines, the stokeholds, the longitudinal and transverse bunkers, and the entire fore part of the vessel up to the engine room bulkhead. The Kingston valves were sprung out of place so that the condenser pumps had to run night and day to save the engine room from being entirely flooded.

The ship took in about 4300 tons of water, and was in a very unstable state of equilibrium, and exposed to the dreaded libeccio (southwest) gales.

She was first secured by two anchors from the bows, and one towards the southwest, and these moorings were strengthened after three days. Battleships anchored to windward continually to afford a lee for operations.

The work was under the immediate direction of General Valsecchi, the head of the corps of naval engineers.



POSITION OF THE SHIP ON THE ROCKS, AUGUST 29, 1911. SHE WAS UP BY THE STERN WITH SUBMERGED TORPEDO-TUBE ABOVE WATER, AND WAS CANTED 6 DEGREES TO STARBOARD.

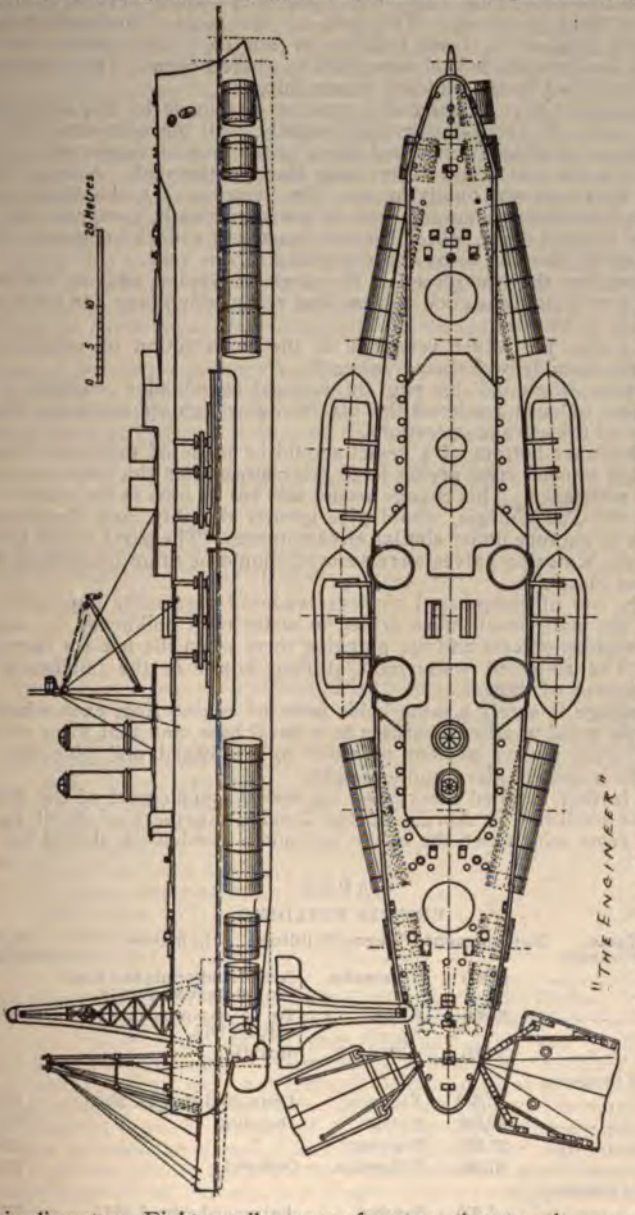
There were four stages into which the operations were divided, all of these proceeding simultaneously:

1. Lightening the ship. This was done by large floating cranes. Removal of coal, fresh water and stores made but 600 tons difference. The guns and mechanism with fore and aft conning-towers made 1070 tons, and the amount of armor eventually stripped off was 95 tons. The two fore funnels were also sent ashore.

2. Expulsion of water. The steam pumps on board were used—a pumping plant was assigned to the various sections of the vessel. Dams of cement made as the work progressed. Collision mats, strengthened first by placing steel nets and cushions of tow over the holes, were used to stop leaks. The compartments representing exceptional difficulties were filled with cork, barrels and earthenware jars. When the forward torpedo room was cleared a centrifugal pump of 200 tons, and a piston pump of 40 tons were set up therein. The capstan room next was used similarly, and so on. The two fore boiler rooms, 49,392 cubic feet of water, were prepared for clearing by compressed air.

3. Cutting away the rock. Small charges of dynamite were used to blast away portions of the rock, and these had scarcely any appreciable effect on the friable volcanic tufa which opened up in fissures instead of splintering.

4. Use of external lifting appliances. Use of slings under her keel was limited to her extremities. Six cylindrical iron caissons were obtained each with a lifting thrust of 350 tons; dimensions, 65.6 feet long by 16.4



PLAN OF THE DISTRIBUTION OF CAISSONS AND PONTOONS, SEPTEMBER 14-15, 1911. ON THIS OCCASION THE VESSEL WAS GOT OFF.

feet in diameter. Eight smaller ones of 55 tons thrust each were obtained. The cylindrical form was found to be very advantageous. Six wooden-decked pontoons of 150 tons each lifting capacity were also obtained. The

total lifting power was thus 3440 tons. This is without counting the powerful floating cranes.

Armor was stripped from ship's side so as to secure thereto six pairs of iron brackets—projecting 14.76 feet therefrom—which served as lifting points for four pontoons. The first of the large cylindrical caissons arrived on August 31, from builders or ten days after being ordered. Five steel hawsers under keel were used to connect them. The compressed air was furnished by the Vulcano repair ship.

On September 8 an unsuccessful attempt was made by the *Dandolo* to tow the vessel off. Work progressed rapidly. All the cylinders were put in place, more weights disembarked, three 75-ton floating cranes were placed so as to lift the stern, and divers kept blasting the reef. A total lifting force of 2500 tons was finally in use. On September 15, the *Sicilia* made fast with four towing hawsers 270 fathoms in length, composed of two lengths of 2.4-inch chain, spliced between lengths of 19-inch hemp rope. This was successful, the *San Giorgio* being pulled off the reef.

The next day she was placed in dry dock at Naples, and on March 21, 1912, she was floated, as good as new, and completely ready for taking her place again in the fleet.

These points for future reference in the construction of vessels were brought out forcibly by General Valsecchi:

(1) Dynamos should be run by internal combustion engines. The atmospheric exhaust rendered the use of water lighters necessary during the whole of the salvage operations.

(2) The inner bottom of a vessel should be made of mild steel instead of the high tension steel giving it 10 per cent greater thickness to ensure the same resistance. This change would add but 12 tons to the weight of a ship like the *San Giorgio*, would give greater ductility, and therefore be less likely to rupture under similar circumstances. The parts of the bottom whereto the Kingston valves were secured should be of an undulating form to increase elasticity.

(3) The use of compressed air was rendered practically impossible because of the many small holes drilled in water-tight bulkheads for attachment of various objects and not plugging them when the use for them had ceased. The so-called water-tight stuffing boxes in the bulkheads are another source of danger.

This salvage is surely a remarkable piece of engineering, even when the facts of the good weather, nearness to a naval base, and that three or four warships were always present to moor to windward and give the *San Giorgio* their lee, are given undue weight.

For a further detailed description the special supplement of the *Rivista Marittima* published in April, and the London *Engineer* of April 19 and 26, 1912, from which two the above account is condensed, should be consulted.

JAPAN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.	To be completed.
Battleships.				
Kawachi	20,800	Yokosuka.	Completed trials and commissioned May, 1912.	
Settsu	20,800	Kure.	To be commissioned July, 1912.	
Fuso	30,000	"	Building.	
Armored Cruisers.				
Kongo	27,500	Vickers.	Launched May 18, 1912.	1913
Haruna	27,500	Kobe.	Building	1915
Kirishima	27,500	Nagasaki.	"	1915
Hiyei	27,500	Yokosuka.	Ordered.	1914
Protected Cruisers.				
Shikuma	5,000	Sasebo.	Launched Apr. 1, 1911.	1912
Yahagi	5,000	Nagasaki.	" Oct. 3, 1911.	1912
Hirado	5,000	Kobe.	" June 29, 1911.	1912

JAPANESE NAVAL EXPANSION.—The *Tokio Asuhi* credits the Minister of the Navy with the following statement at a secret session of the Fourth Section of the Budget Committee in reply to an interpellation on the contemplated naval expansion program, postponed from the present year.

The Minister is reported to have said: "It is impossible to tell with exactitude just now how the naval scheme is to be carried out from the fiscal year 1913-1914, but if the financial condition of the government allows it will be necessary to build 18 vessels to form a unit of the fighting line—eight battleships of the super-*Dreadnought* type and eight (possibly only six) armored cruisers of the latest type. In addition, sixteen smaller cruisers and special service vessels must be constructed, but the cost of these latter would be comparatively small. The whole of this new fleet must be constructed in seven years from next year, 1913. Possibly if the financial conditions are stringent the period could be extended to ten years. As a seven-year scheme the annual appropriation would be $25,000,000, as a ten-year scheme $17,500,000. Without these sixteen vessels it would be possible for Japan to fight any battle worthy of the name against the 21 big ships which a certain power will have at that time. This forms the irreducible minimum of naval expansion.—*Shipping*, Illustrated.

Even if America continues to lay down two *Dreadnoughts* or super-*Dreadnoughts* a year her strength in this type of ship in 1920 will, as compared with that of Japan, be as follows, on the assumption, of course, that the new Japanese program is adopted and completed to time:

Completed Dreadnoughts in 1920.

	America.	Japan.
Armed with 12-inch guns	8	2
Armed with 14-inch guns	4	4
Armed with 14-inch or heavier guns	12	17
	24	23

—*Scientific American.*

JAPANESE NAVAL CONSTRUCTION, 1912.

	Completed.	Building.
Battleships	13	3
First-class cruisers	13	4
Second-class cruisers	9	3
Third-class cruisers	8	..
Coast defence vessels	7	..
Gunboats	4	1
Despatch boats	6	..
Torpedo depot ships	2	..
Destroyers	58	2
Torpedo-boats	57	..
Submarines	12	1

THE BUDGET.—The Marine Minister Saito stated to the Budget Committee that Japan requires 18 super-*Dreadnoughts* which should be built in the course of 7 years after 1913. When Minister Saito was questioned in regard to this reported government policy to so largely increase the navy he said that the plans were not ready to be published as it was a secret of national defence, but he stated that it was contemplated to have 6 additional armored cruisers instead of 8. The contemplated program of 18 new ships includes the *Kawachi* and *Settsu*, as also the *Aki*, which, latter, would, however, not be equal to the newer proposed super-*Dreadnoughts* of which they want 8, and also 6 or 8 new armored cruisers. The financial conditions are such that this increase is postponed another year.—*Marine Rundschau.*

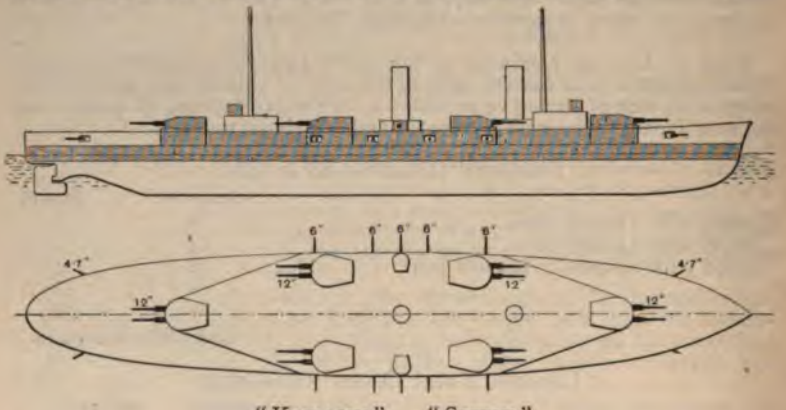
Among other features of the new budget there is a sum of $19,500 for entertaining foreigners.

In a comparison of the personnel strength of the navies of England and Japan it is claimed that there is no need for having any cadets enter the Japanese Navy during the next few years because the comparison shows:

Warship.	Displacement. Tons.	Officers.	Men.
England	2,105,450	4818	104,300
Japan	465,765	3034	52,800

DOCKS.—The floating dry dock that has been building at Sasebo during the past four years has been launched. This has a capacity of 30,000 tons, length 776.8 feet, width is 331 feet. This is the largest dock in Asiatic waters at the present time.—*Marine Rundschau.*

The battle-cruiser *Kongo* will leave Vickers' works shortly under the command of Captain Idekenji, now naval attaché at London.



"KAWACHI." "SETTSU."

Length, 480 feet; 20,800 tons; speed, 20.5 knots; building; armament, twelve 12-inch; ten 6-inch; twelve 4.7-inch.

—From *Brassey's Annual.*

The fast battleships *Kongo, Haruna, Kirishima,* and *Hiyei* will each have eight 13.88-inch guns. This new gun will weigh 86 tons and will fire a shell weighing 1861 pounds. The life of each gun is to be 250 shots with full charges.

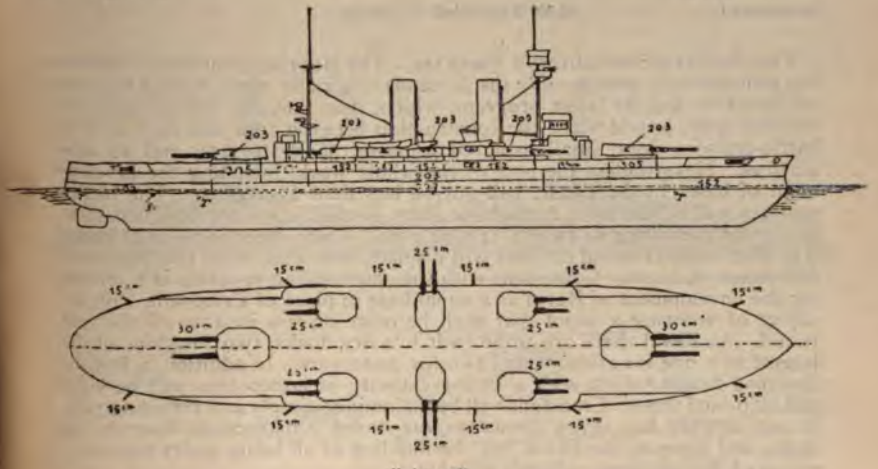
Speed will be 25 to 27 knots with 75,000 horse-power. The armor at water-line is 9.9 inches thick. They will have sixteen 6-inch guns. The battle-ship *Fuso* is reported to be of 30,000 tons and to mount 15-inch guns.

"AKI" AND "SATSUMA."—The *Aki* and *Satsuma,* recently commissioned, are the first large battleships to be built in Japan, and consequently much interest attaches to them. The latter was built at Yokosuka, the former at Kuré. There was a lapse of five years between the laying down and commissioning of the *Aki,* but during this period much other construction work was underway. Much discussion has been caused by the fact that the Japanese have held to the six-inch and eight-inch guns; or to a three-caliber ship, and they are presumably reasoning from lessons of the late war. There is, however, reason to believe that the departure from the "all-big-gun" ship was due to the fact that the Japanese Admiralty considered the difficulty of building such at that time too great to conquer.

The *Satsuma* is a bigger and better *Lord Nelson*, and is the last word in the three-caliber ship. The *Kawachi* and *Settsu*, now under construction, carry only twelve 12-inch guns. The *Aki* is slightly the larger of the two ships.

The portion of these ships protected by armor is greater than that in the *Lord Nelson* and much greater than that in the *Danton*. The *Danton* has the most freeboard. These Japanese ships are superior to the *Lord Nelson* and *Danton*.

The *Aki* has Curtis turbines, and the *Satsuma* reciprocating engines, and the latter has one less funnel than the *Aki*. The *Aki* made easily 21 knots with 25,000 horse-power, while the *Satsuma* made but 20.5 knots with 18,500 horse-power. The boilers are Japanese, *Mijabara*. The turrets are worked both electrically and hydraulically. Both vessels carry torpedo-nets.—*La Vie Maritime*.



"AKI."

Length, 481 feet; beam, 83.3 feet; draft, 28.5 feet; displacement, 19,250 tons; armament, four 12-inch; twelve 10-inch; twelve 6-inch; four 3-inch; 5 submarine torpedo-tubes.

SOME NAVAL ACCIDENTS.—November, 1911. A charge exploded in a 12-inch turret while proving the gun. All the mounting was wrecked and 10 men were killed.

The torpedo-boat destroyer, *Harukase*, struck by a gale, was lost, with 45 men of her crew.

The breech block of a 30.5-cm. gun was blown out at target practice in Aomori Bay by which 10 men were killed.

PERU.

Peru purchased the old French armored cruiser *Dupuy de Lome* for $600,000. This vessel left the *Lorient* in April, 1912, for Callao. The firm of Creusot is now building a submarine of *Laubeuf* type for Peruvian Navy.

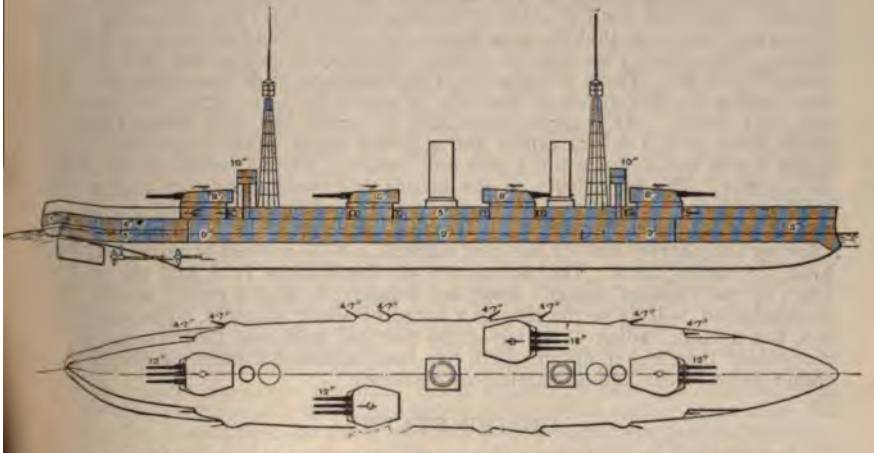
PORTUGAL.

PROGRESS IN 1911.—Portugal has adopted a naval ship building program to provide the republic with three battleships each of 20,000 tons, three scouts of 3500 tons, 12 destroyers of 820 tons, and 6 submarines of 350 tons.

A floating dock is to be built at Nikolaieff capable of accommodating the new *Dreadnoughts*. Designed to float 40,000 tons and to be completed March, 1912.

NOTES.—The schoolship *Rynda* has been fitted with Diesel motors. The Russian chain of wireless stations has been increased by new stations in Kamchatka and Siberia.

AUXILIARY VESSELS.—*The Russians are paying a great deal of attention to mine-laying vessels.* Three old ships were rebuilt and completed as mine layers, viz.: *Ladoga, Narowa* and *Onega*. The transports *Beresan* and *Schilka* are being converted into mine-laying vessels in the Black Sea. These mine-laying vessels are now organized into a squadron of mine layers under special command.—*Marine Rundschau.*



"GANGOOT." "PETROPAVLOSK." "POLTAVA." "SEVASTOPOL."

Length, 590 feet; 23,000 tons; speed, 23 knots; armament, twelve 12-inch, sixteen 4.7-inch, 4—small.

—From *Brassey's Annual.*

The Russian Navy will build at Nikolaieff a submarine boat for mine-laying purposes, 170 feet long and of 500 to 700 tons displacement, fitted with Curtis' turbines for surface cruising and electric motors for submerged runs. The boat will have two torpedo-tubes and will carry four torpedoes. The mine-laying outfit will be located in a caisson, built above the hull, divided in two compartments and running the whole length of the hull. Each compartment will stow 30 mines and mines will be laid from the after end by means of an endless chain.—*Shipping*, Illustrated.

The Russian school of aviation has received four flying machines of the Newport type. Sixteen more of this type have been ordered from France.

ARTICLES OF WAR.—The Czar has changed the Russian Navy regulations in regard to surrendering a ship of the navy so that it now reads: "It is the duty of the captain to destroy his ship when there is no possibility of continuing the action, and when there is any likelihood of being captured by the enemy.—*Marine Rundschau.*

SPAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
España.....	15,400	Ferrol.	Launched Feb. 6. 1912.
Alfonzo XIII.....	15,400	"	Launched.
Jaime I	15,400	"	Building.

These ships are notable for the great fighting power embodied in limited dimensions. The length between perpendiculars is only 435 feet; the beam, 78 feet 6 inches; and the draft, 25 feet 6 inches; with a displacement of 15,450 tons. Eight 12-inch guns are mounted, and the twin-gun barbettes are so arranged that all of the guns may fire on either broadside, while six may fire ahead and six astern. This has been achieved by placing two guns on the port side and two on the starboard side, with a very considerable distance separating the barbettes in the longitudinal line; the only obstruction is one funnel, so that the guns have a very wide arc of training on both beams. The other guns are, of course, mounted in center line barbettes forward and aft. There are also ten 4-inch guns on each broadside, all of them within the side armor of the ship. Four of the 4-inch guns fire ahead and four astern. As regards protection, the main belt is 9 inches thick, while above this is 6-inch armor and a 3-inch upper strake to protect the upper works and to form the 4-inch gun battery. The barbettes are of 10-inch armor. The main belts on the broadside extend right fore and aft, but are reduced forward and aft to 4 inches in thickness. A notable feature is that, almost extending the whole length of the ship, there is on each side, forming the interior wall of the coal bunkers, a fore-and-aft armored bulkhead 1½ inches thick. The boilers are of the Yarrow type, and the turbines of the Parsons' design; these are designed to give a power which, it is anticipated, will drive the ship at a speed of about 20 knots. The vessel, too, has a large radius of action—7500 nautical miles—so that it must be recognized that in her design there has been achieved a most satisfactory compromise of conflicting claims.—*Engineering.*

UNITED STATES.

VESSELS BUILDING.

No.	Name.	Speed. Knots.	Where Building.	% of Completion Mar. 1.	Apr. 1.	May 1.
	Battleships.					
32	Wyoming....	20½	Wm. Cramp & Sons.	93.5	94.9	97.0
33	Arkansas....	20½	N. Y. Shipbuilding Co.	90.9	93.7	96.0
34	New York...	21	Navy Yard, New York.	26.8	30.4	35.3
35	Texas.....	21	N'pt News S. B. Co.	56.1	59.0	61.9
36	Nevada	20.5	Fore River Co.	0.	0.	0.
37	Oklahoma ...	20.5	N. Y. Shipbuilding Co.	0.	.6	.7

THE NEW UNITED STATES BATTLESHIPS "NEVADA" AND "OKLAHOMA."—The navy has every reason to be pleased with the design of our latest battleships, the *Nevada* and *Oklahoma*, contracts for the construction of which have recently been let to the Fall River and the United States Shipbuilding Companies. These ships represent, to a greater degree than any of their predecessors, the united experience and thought of the various branches of the naval service; and the officers of both line and staff unite in the belief that these two ships are the most powerful vessels afloat or under construction to-day. The armor plan is particularly effective and decidedly original, and in a comparison with previous vessels it will be noted that there are some very radical departures from existing practice.

The *Nevada* will be driven by Curtis' turbines and the *Oklahoma* by reciprocating engines. The boilers in both ships will be fired exclusively with oil, and they will carry no coal. The estimated speed is 20½ knots.

The considerations which led to the adoption of the three-gun turret were that, by elevating, training and firing the three guns together, great assistance will be rendered to the spotter in determining the fall of the shots, and he will be able to telephone the corrections with much greater accuracy than he could if the guns were fired separately. The armament will consist of ten 14-inch guns, carried in four turrets, disposed as follows: On the forecastle deck will be first a three-gun turret, then a two-gun turret. On the quarter deck will be a two-gun turret and astern of that a three-gun turret. This arrangement will give a concentration of fire superior to that obtainable from the ten 14-inch guns of the *New York* and *Texas*, which will be mounted in five two-gun turrets.

The new 14-inch 45-caliber gun is a far more powerful weapon than the 45-caliber, 12-inch gun, mounted on the *Delaware* and *North Dakota*. The muzzle energy of the 12-inch piece is about 49,000 foot-tons, whereas that of the 14-inch piece is about 66,000 foot-tons. Moreover, its shell, which weighs 1400 pounds as compared with the 870-pound weight of the 12-inch carries a much larger bursting charge of high explosive and, therefore, will be proportionately more destructive.

The principal interest of the new ships lies in their great defensive power. Not only will they carry a much greater weight of armor than has been carried, or is to be carried, by any ship built or building, but the armor will be disposed to greater advantage. The chief duty of a warship is to maintain her stability and her mobility, and at all times present a completely protected emplacement for her guns. In other words, she must not only carry her guns into the fight, but she must nurse them through all its savage hammering, so effectually that they shall be able to pour shell into the enemy until they have silenced or sent him to the bottom.

So let us see how these conditions have been met in our new ships. Taking the *North Dakota*, for instance, as a basis of comparison, we find that the armor protection has been entirely removed from the secondary battery of 5-inch guns—a wise step, which might well have been taken several years ago. For it is a fact that the 5, 6 or 7 inches of armor with which the secondary batteries of warships of to-day are protected, will simply serve as a shell-burster, delaying the high explosive 14-inch shells long enough to cause the little firing hammer within the shell to leap forward and detonate the high explosive, the burst taking place after the shell has passed through the armor and is well within the body of the ship. So the torpedo-defence guns will have nothing in front of them except the ordinary ½-inch or ⅝-inch plating of the ship's side, which may very well allow the shells to pass through without bursting among the gun crews crowded about the guns.

The most important armor on a ship is undoubtedly the belt armor upon the hull itself; for to this is committed the duty of keeping the ship afloat and preventing projectiles from striking a vital blow in the magazine, boiler rooms or engine rooms. In the new ships the belt will be 17½ feet in width and, at mean draft, it will extend from 9 feet above to 8 feet 6 inches below the water. It will have the unprecedented thickness of 13½ inches, which it will maintain from its upper edge down to within a few feet of its bottom, where it will begin to taper to a minimum width at the bottom of 8 inches. Very rarely, if ever, will the bottom edge of this deep belt be rolled out of water, exposing the thin plating below. This belt will extend for over 400 feet along each side of the ship. It will terminate well forward of No. 1 barbette, where it will be carried, with the same depth and thickness, entirely across the ship. At its after end the belt armor will be carried at its full depth of 17½ feet to a point about 30 feet aft of No. 4 barbette. Here there will be a jog, the depth of the belt decreasing from 17½ feet to 8½ feet, at which depth it will be continued aft for another 60 feet. Transverse bulkheads of the same thickness as the belt will here be carried across the ship.

An important feature of the side armor is the manner in which the plating will be laid on the ship. Hitherto the armor has been placed horizontally,

SPAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
España.....	15,400	Ferrol	Launched Feb. 6. 1912.
Alfonzo XIII.....	15,400	"	Launched.
Jaime I	15,400	"	Building.

These ships are notable for the great fighting power embodied in limited dimensions. The length between perpendiculars is only 435 feet; the beam, 78 feet 6 inches; and the draft, 25 feet 6 inches; with a displacement of 15,450 tons. Eight 12-inch guns are mounted, and the twin-gun barbettes are so arranged that all of the guns may fire on either broadside, while six may fire ahead and six astern. This has been achieved by placing two guns on the port side and two on the starboard side, with a very considerable distance separating the barbettes in the longitudinal line; the only obstruction is one funnel, so that the guns have a very wide arc of training on both beams. The other guns are, of course, mounted in center line barbettes forward and aft. There are also ten 4-inch guns on each broadside, all of them within the side armor of the ship. Four of the 4-inch guns fire ahead and four astern. As regards protection, the main belt is 9 inches thick, while above this is 6-inch armor and a 3-inch upper strake to protect the upper works and to form the 4-inch gun battery. The barbettes are of 10-inch armor. The main belts on the broadside extend right fore and aft, but are reduced forward and aft to 4 inches in thickness. A notable feature is that, almost extending the whole length of the ship, there is on each side, forming the interior wall of the coal bunkers, a fore-and-aft armored bulkhead 1½ inches thick. The boilers are of the Yarrow type, and the turbines of the Parsons' design; these are designed to give a power which, it is anticipated, will drive the ship at a speed of about 20 knots. The vessel, too, has a large radius of action—7500 nautical miles—so that it must be recognized that in her design there has been achieved a most satisfactory compromise of conflicting claims.—*Engineering.*

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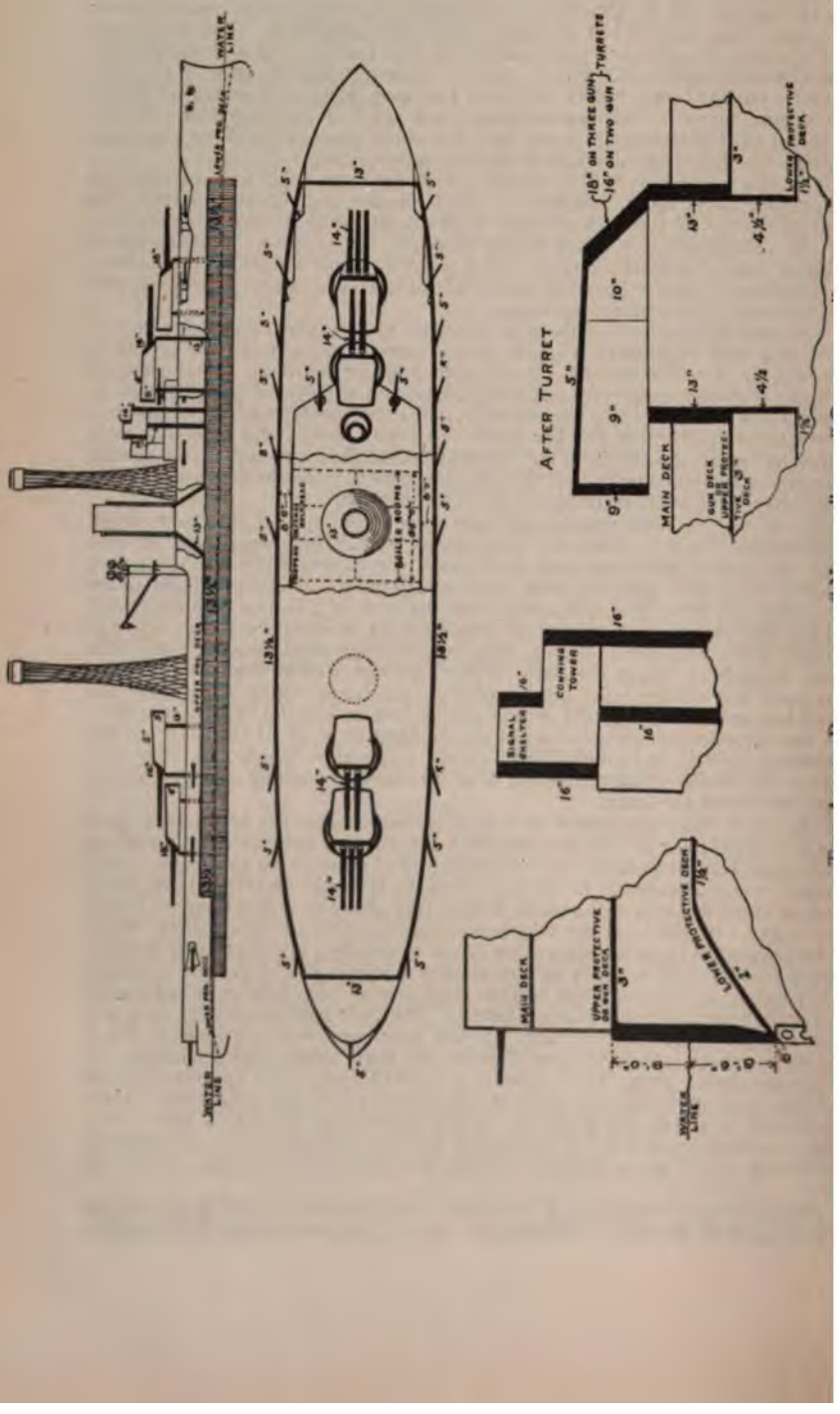
in two strips, with a continuous horizontal joint, located slightly above the water-line, between the upper and lower strip. This had the disadvantage that it presented a continuous line of cleavage, near the water-line, and, therefore, at a most vulnerable point. In the new ships the armor plates are laid vertically, the joints being vertical and the plating extending the whole depth of the belt without any continuous joint at the water-line. This is a most important improvement which will add greatly to the protective power of the side armor. Associated with the heavy belt in the work of protecting the ship's stability are two protective decks—a lower deck 1½ inches thick on the flat which will slope along the sides to a junction with the bottom of the armor plate 8½ feet below the water-line. The slopes of this deck are 2 inches in thickness. On the deck above (the gun-deck) is an upper protective deck, 3 inches in thickness. These two decks provide an excellent protection against plunging fire, and also against fragments of shells which might be exploded in passing through the thin ship's plating in the wake of the gun-deck.

Equally massive is the armor protection for the main gun positions. The barbette armor extends, with a thickness of 13 inches, from the turret down to the upper protective deck, and from the upper to the lower protective deck the thickness is reduced to 4½ inches—this because of the 13-inch protection afforded by the side armor. The turret armor is equally massive. The port plate is 16 inches on the two-gun turrets and 18 inches on the three-gun turrets, and the side and rear armor is 10 and 9 inches in thickness, while the roof carries 5 inches of armor.

The battle of the Sea of Japan showed how important it is to thoroughly protect the positions from which the fighting of the ship is controlled, and particular attention has been given to this in our new design. The conning-tower and the signal station back of it each carry no less than 16 inches of armor, and to protect the communications—telegraph and telephone wires, voice tubes, etc.—the section upon which conning-tower and signal station are supported has walls of 16-inch armor, which are carried down to the protective decks.

It will be noticed that the new ships have but one smokestack—and thereby hangs a tale. The new ships, as already stated, will burn fuel oil exclusively. This has enabled the designer to dispense entirely with coal bunkers—the oil being carried chiefly in the double bottom of the ship. The omission of bunkers sets free a large amount of space below decks, which has enabled the designer to concentrate all of the six boiler compartments at the center of the ship, where they occupy only 65 feet of her length. Hence, it was possible to use a single smokestack, placed immediately above the boiler rooms, and hence, again—and this is the important point—it was found possible to place around the whole of the uptakes a massive redoubt of inclined armor with walls everywhere 13 inches in thickness. This redoubt extends from the upper protective deck to the spar deck, and that portion of the smokestack and uptakes which is within the structure of the ship will be completely protected against perforation. The importance of this construction will be appreciated, when we bear in mind that, in the Japanese War, it was the perforation of the uptakes which contributed largely to the collapse of the Russian ships. The poisonous gases, escaping between decks, were drawn down and disseminated throughout the ship, frequently driving the crew from their quarters.

From the above description it will be evident that in the *Nevada* and *Oklahoma* the United States Navy will possess two fighting ships which will be the equal, if not superior, to any ships in their gun power and which will be greatly superior in their power of endurance in a long-drawn-out fight. If Congress will only be wise enough to add year by year the two battleships which represent the minimum requirement of our navy, we shall be in a position to maintain our standing among the navies of the world. If less than two battleships a year be authorized, our navy will steadily retrograde.—*Scientific American.*


AFTER TURRET
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The *Florida's* speed of 22.54 knots has only been nearly equalled by the *Vanguard* (English) with 22.50 knots to her credit.

The *Texas* was launched May 18, 1912, at Camden, N. Y.

THE "HENLEY."—The principal dimensions of the torpedo-boat destroyers *Henley* are as follows: Length between perpendiculars, 289 feet; length over all, 293 feet 10½ inches; breadth moulded, 26 feet 4½ inches; trial displacement, 742 tons; trial draft, 8 feet 4 inches. Battery—five 3-inch guns, three 45-cm. torpedo-tubes on deck, two .30-caliber automatic guns.

The machinery spaces occupy the amidship portion of the destroyer, the installation consisting of four Fore River-Yarrow water-tube boilers. The vessel is fitted with two 18-stage Curtis reversible marine turbines, 63 inches in diameter and capable of developing 5500 S. H. P. each, at about 585 revolutions per minute, which will give the vessel a speed of 29½ knots per hour. For the purpose of bettering the economy of consumption of steam at low speeds there has been fitted at the forward end of each turbine, and connected to it by means of a jaw clutch, a 10½ x 22 x 10 inch stroke vertical, compound, reciprocating engine, which at 16 knots is intended to develop 400 I. H. P. at 280 R. P. M., with a steam pressure of 250 pounds in the high-pressure chest. The steam, after passing through this engine, is put through the turbine and the energy remaining in the steam after passing through the reciprocating engine is extracted down to the last ounce of pressure in the turbine. Shop tests of this unit conducted by the Naval Board last December, showed, according to the report of the Board, that the gain in economy at 16 knots amounted to 33 per cent; at 13 knots, 62.4 per cent, and at 10 knots, 98.96 per cent over the performance of the turbine under similar conditions of steam. The contractors guaranteed that the gain at 16 knots would be 25 per cent. It is expected that the *Henley* will be the most economical torpedo-boat destroyer in the U. S. Navy at all speeeds from 10 knots up to 31.—*The Nautical Gazette.*

It is probable that the new fuel ships authorized by the Naval Appropriation bill now pending in the House Naval Committee will be constructed so that they can be converted into coal or oil carrying vessels. As far as that is concerned all of the fuel ships will be built so that they carry either fluid fuel or coal. This can be done by extra riveting. The *Orion, Jason, Proteus* and *Nereus*, now under construction, will carry both coal and oil. They will have bunkers for 12,500 tons of coal and 900,000 gallons of oil. The fact that the new battleships *Oklahoma* and *Nevada* will be oil burners makes it necessary to provide a larger fluid fuel carrying capacity for the navy's auxiliaries.—*Army and Navy Journal.*

COLLIER "ORION."—This vessel was launched March 23. The *Orion*, while practically a duplicate of the *Neptune*, has many claims for attention. The keel plates were not laid until October 6 of last year, and her launching to-day establishes a new record for American shipyards in the time consumed between laying the keel and the launching of a ship of her size.

She is 514 feet in length between perpendiculars and 536 feet over all; has a molded beam of 65 feet and a depth of 39 feet 6 inches. Her hull is constructed under the Isherwood system of horizontal framing, which until two or three years ago was unknown in this country. The first ship ever built under the Isherwood system was built at the Point and was the *Millinocket* for the A. S. Bull Steamship Company, of New York.

The *Orion* will carry 12,500 tons of coal, which means all that a solid train of coal cars two miles long can handle. Her twin screws will drive her at the rate of 14 knots an hour when loaded. The coal unloading device is the design of the local company and will handle 100 tons an hour from each hatch. In addition to capacity for coal, she is also provided with tanks for fuel oil. Oil may also be carried in the double bottoms under the regular cargo holds.

Two triple expansion engines will develop 7000 horse-power. The diameter of the cylinders will be 27, 46 and 76 inches, respectively, by a 48-inch stroke. Steam will be furnished by three double-ended boilers, each of which is 15 feet 10½ inches in diameter, by 21 feet 2½ inches long, weighing 150 tons and carrying a working pressure of 200 pounds.

These new colliers are among the finest afloat and compare with any in the navies of the European countries. There are accommodations for 25 officers and a crew of 152. The officers' quarters are to be finished in oak, and those for the crew in cypress.

COALING.—Rear-Admiral Osterhaus, commander-in-chief, in a wireless report to the Navy Department on March 18 said that the *North Dakota* had established a record for coaling while under way at sea, having taken aboard 499 tons from the collier *Vulcan* in one hour and averaging 410 tons an hour for four hours.—*Army and Navy Register.*

ORDNANCE AND GUNNERY.

GUNS AND PROJECTILES.

SIZE OF GUNS.—*Le Yacht* considers the 12-inch large enough to penetrate all existing armor, and that the 12-inch heavy shells hold plenty of high explosives to produce terrible destruction. Certain navies have adopted a larger caliber because the metal of the guns was being strained beyond its limit of resistance. The English especially worry over the life of their guns. The firing trials of the *Saint Vincent* class showed deep erosive grooves in the powder chamber and near the muzzle. Therefore, to reduce this, a greater caliber became necessary. 13.7-inch and 14-inch were adopted, and, as foreigners adopted this increase in size the French had to also, though their 12-inch had a very long life. The larger caliber in spite of the smaller initial velocity increases the striking effect especially at long ranges. The 13.7-inch shell will penetrate at 7000 yards the same thickness of armor that a 12-inch will at close range. The former's danger space is greatly increased.

In the battleships of 1913 it is stated that the Italians will readopt the 12-inch caliber. It is alleged that the reason for adopting the 12-inch caliber is that neither the Vickers-Terni works nor the Armstrong factories are at present in a position to supply guns of a larger caliber, and on national and economic grounds it was not thought wise to resort to British or other foreign establishments. Moreover, it is stated that experiences with guns of a heavier caliber, which had come to the knowledge of the Italian authorities, have not encouraged them to adopt anything larger than the 12-inch.—*Army and Navy Gazette.*

Japan has had a 15-inch gun sent out from England and intends to mount such weapons in a battleship to be built in Japan and to be completed by 1915. (Note the Japanese statement to contrary in No. 141.)

Should it be demanded of a gun of a lower caliber firing a lighter projectile at a higher muzzle velocity, or of a larger caliber gun firing a heavier projectile at a lower muzzle velocity? So long as the metal used for the gun, the system followed in the construction of the latter and the powders fired, have not varied to any very great extent, experience has invariably confirmed, up to the present time, the very great advantage to be derived, from every standpoint, by an increase in the gun caliber. The development of naval ordnance shows this at a glance. It is also a well-known fact that the comparative superiority of the larger caliber gun asserts itself in increasing degree as the range at which a naval engagement takes place is augmented.

From the point of view of the artillerist the conclusions are quite clear. He is able, using a 13.5-inch, 14-inch, or 15-inch gun, to supply a residual energy equal, and even superior, to that given by a 12-inch 50-caliber gun, while demanding from the metal forming the gun—and this is most important—an amount of work which decreases directly in proportion as the caliber increases. He is able, therefore, to build guns which not only gradually increase in power, but whose life will also increase. These guns will impart to their projectiles a perforating power at long ranges which will gradually increase with the caliber, and the points of fall will be easier to note. In the second place, the perforating power of the projectiles is decidedly better utilized with the increase in caliber, for the percentage of efficiency of increased caliber is greater than that of increased thickness of plate—a 13.5-inch projectile will more easily perforate 13½-inch armor than will a 12-inch shot attacking a 12-inch plate. In other words, if it is practicable to improve the resisting power of armor by adding to the thickness beyond 12-inch, projectiles fired by the higher caliber guns will be far less handicapped than those fired from the 12-inch gun.

Further, in addition to greater perforating power in the projectiles of the higher calibers, they enable a higher proportional explosive charge to be used. In the opinion of several officers a 12-inch projectile, weighing about 1000 pounds, can contain an explosive charge having approximately 3 per cent its weight, without losing any very great proportion of its perforating power. It is not unreasonable to suppose that a 14-inch shell, weighing, say, 1540 pounds, can, under the same conditions, contain a charge of 3.5 per cent, and a 15-inch shell of 1765 pounds a charge of 4 per cent. This gives for the latter an explosive charge weighing 70 pounds—quite close to that of 75 pounds of non-armor-piercing shell which caused an enormous amount of damage in the late Russo-Japanese War. It is absolutely certain, however, that a 15-inch projectile would be far more dangerous against a modern battleship than any 12-inch projectile containing the 7.5 per cent of explosive charge.—*Engineering.*

DATA OF GUNS.

Caliber.	Nationality.	Projectile.	Charge.	I. V.
11-in./45	German	680	248	2900
12-in./45	British	850	330	2900
12-in./50	U. S.	870	310	2700
12-in./50	British	850	350	3000
12-in./45	German	875	329	3000
14-in./45	German	1400	508	2870
13.5-in./45	British	1250	510	2870
14-in.	Japanese	1869		
13.5-in.	Japanese	1250		

FRENCH HEAVY GUNS.—The 1910 pattern 9.5-inch French gun, built for coast defence, has had to be withdrawn. One of these guns blew out its breech-block at proof in September, 1910; two months later a second burst explosively, the breech portion being blown to pieces; and three more of these guns have since shown signs of weakness. The cause is difficult to discover, since the only point in which this pattern differs materially from earlier designs is in the breech-block, which is a new pattern of stepped screw. It fires a 500-pound shell with charge of 147 pounds of gun-cotton powder, or about the same charge and projectile as our own 10-inch, which is a heavier gun. Possibly the instability of the French powder is again in fault. If so, the French Navy will sooner or later be forced to abandon it in favor of cordite, which, with all its defects, is at least a safe propellant.—*Army and Navy Gazette.*

LIFE OF NAVAL GUNS.—We worry about the small number of rounds per gun which magazines of our battleships hold. The length of a battle limited

by this number of shots will appear very short, and furthermore it is quite likely that the life of the guns, if they are not new, will make a quicker end to the fight than the exhausting of the ammunition supply. Commander Ettore Bravetta, of the Italian Navy, an ordnance expert, gives in an article in the *Rivista Nautica*, the following table:

Caliber.	Rapidity of fire. Seconds. Time between shots.	Maximum number of shots the gun can stand.
12/45	60	100
12/50	60	86
13.3	80	80
14	90	75
16	110-120	65

The rapidity of fire is generally greater than that given above, but it is necessary to consider the actual delays in action. In adopting the foregoing as a base from which to reckon, we see that a ship having an absolutely new armament could not fight longer than one hour and forty minutes with her 12-inch guns, . . . and but a little over two hours with guns of 14 or 16 inches in caliber.

The above table refers to guns using a nitroglycerine powder. In the French service, we consider that 12-inch guns will fire 200 rounds.—*La Vie Maritime.*

AERIAL QUICK-FIRING GUN.—A new quick-firing gun has been produced by Messrs. Vickers for use on dirigibles and aeroplanes. The weapon has been taken to the company's Eskmeals range on the Cumberland coast, where it has been thoroughly and successfully tested. It is of very light construction, is shaped almost like a telescope, and weighs probably not more than 1 cwt. It is easily trained and worked, and is reported to be a weapon which can easily be carried by an aeroplane or airship.—*Page's Weekly.*

DAVIS AEROPLANE GUN.—What is claimed to be the largest aeroplane gun yet made was successfully tested March 20, 1912, on a barge off Fort Wright in the presence of a number of the United States naval and army officers. The gun was fired twice, and although it is mounted on delicate steel springs, there was absolutely no recoil.

The inventor of the gun is Commander Cleland Davis, U. S. N. It is a 4-inch gun, 12 feet long, weight 150 pounds and fires a projectile weighing 33 pounds at a velocity of more than 1000 feet per second. The gun is made of vanadium steel.

Commander Davis and others expressed themselves as extremely well pleased with the test. After a few minor changes have been made, the gun will be shipped to Washington to be officially tested by the government.

A NEW PROJECTILE.—The French coast defence batteries have recently been equipped with a new type of shell for use against armored ships. Ordinary shell with ogival heads ricochet from the surface of water, and any rounds which pitch short of a ship, however close up, are lost. But the P shell, as it is called, has a long conical point with projecting ogival shoulders, and the effect of this particular shape of head is that at long and medium ranges the shell does not ricochet but dives under the water at an angle of 20 degrees to the surface, and, if it falls within 50 meters of the ship, it strikes the unarmored side below the armor belt, and there detonates. The difficulty in designing the shell has been to provide a fuse that will not act on striking the water, but will explode the shell on striking the ship. This difficulty has now, presumably, been overcome, but the details of the fuse are kept secret.—*The Army and Navy Gazette.*

Up to April, 1912, the only nations adopting the 3-gun turrets are Italy, Russia, Austria and the United States.

ARMOR.

SIMPSON PROCESS.—This is used to weld a high-speed steel to a soft steel, or to make armor composed of alternate layers of hard and soft steel. Trials have been made of a plate having two inches of hard steel welded to four inches of soft steel. Results were highly satisfactory. Mr. W. S. Simpson invented this process which is to place two steel plates with a layer of copper between them in a mixture of carbon, brown sugar, and water, of the consistency of compressed snow, and to submit the whole mass to a temperature of 2000° F. The copper melts away into the steel and forms a perfect weld as examination by stress and microscopic tests has proven.

VANADIUM PLATE.—These are used successfully for deck plating up to three inches in thickness and give most remarkable results. The plate is exceedingly tough. In addition to the adoption in United States of this type of plate, Germany and Great Britain are considering it.

FIRE CONTROL.

POSITIONS.—The latest German vessels are not fitted with fire control positions aloft, and we infer that they do not control their fire by observation of fall of shot as in ours and the British navies. So far as experience goes, while a position in a conning-tower with use of periscope is practicable, it is difficult to understand how it can be efficient.

It is reported that the Germans have made wonderful advances with periscopic observations. Their control station is amidships between decks. At this station by means of tubes and prisms all quarters of vision are commanded, and images made on parabolic reflectors. Distances are exactly determined by special contrivances. Supplementary telescopic tubes are fitted on each side of ship having total reflection prisms just above load water-line, and similar prisms at the station end of the tube allow the control officer free vision over a limited area. This system was originated by experimentation with submarines.

The masts used in our navy save weight over that type used in England, but offer a conspicuous target at a long distance. Argentine and Russian ships are fitted with these cage masts, those in the latter navy being of two types. Those of the *Imperator Pavel* class are similar to ours, those on the *Gangoot* class carry the cage construction to height of 77 feet, the fire control top being located there, from which a pole mast, for signalling, rises 66 feet more.

RANGE FINDERS.—The 9-foot base Barr and Stroud, Zeiss or Bausch and Lomb range finders are located in the tops as in the British Navy, and in other navies in armored towers from which a good view of the horizon is obtained. It is claimed that the German range finders mounted in their turrets are marvels of accuracy and for that reason no station aloft is necessary for putting shots on the target. Instruments to correct the range for the relative courses and speeds of the enemy are in use. The instrument of Captain Dumaresq, combined with the Vickers' clock, is used abroad. For transmitting readings electric devices are most commonly used. The French have some pneumatic and hydraulic instruments working on the Bourdon pressure gauge principle. Many navies are working to the end that the sights both range and deflection will be automatically corrected at each individual gun.

Nothing can be learned as to the results obtained on the *Neptune* with the battery arranged so that elevation and train both were in the hands of the fire control officer. These tests were held in March, 1911, and are said to have been encouraging.

TORPEDOES AND MINES.

PROTECTION OF BATTLESHIPS AGAINST MINES AND TORPEDOES.—The various technical journals of the world are now widely discussing this interesting topic.

A brief glance at some of the mine disasters of the Russo-Japanese War shows that the Russians lost the battleships *Petropavlovsk* and the *Pobyeda*, the cruisers *Yenisei* and *Boyarin;* the Japanese, the battleships *Hatsuse* and *Yashima*, and the destroyer *Akatsuki*.

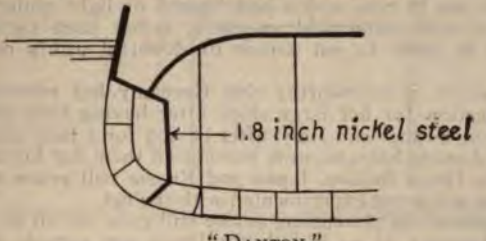
Among the torpedo disasters we note those of February 9, 1904, when the *Pallada, Cesarevitch* and *Retvisan* were so badly damaged that they were out of the fleet until July, and that the sinking of the *Alexander III, Suvoroff, Borodino, Siretlana, Sissoi Veliki, Nakinoff* and *Vladimir Monomach*, at the battle of Tsushima, was due mainly to torpedoes.

The necessity of good protection under water and above against mines and torpedoes is thus very apparent.

The two methods of protection thus far considered are first structural—subdivisions or armor plating the hull—and second, the use of nets.

There seems to be a fairly uniform opinion that one should employ a strengthened longitudinal bulkhead at some distance from the outer skin together with a good system of cellular compartments.

Some known facts regarding under-water protection in modern ships are these (*Journal of Royal United Service Institution*):



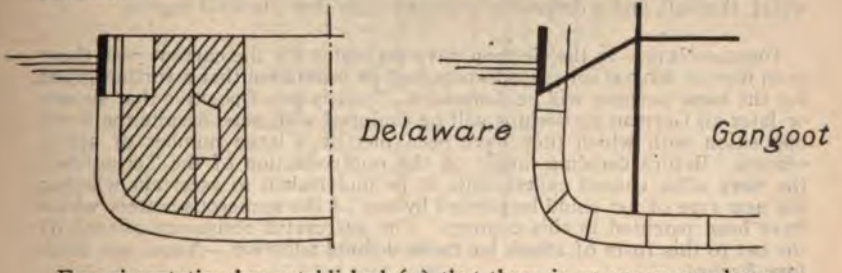
"DANTON."

This French vessel has an interior bulkhead, as shown, comparatively close to the ship's side, and curving in a marked degree at the upper and lower parts until it meets the outer skin. The object of this is conjecture only.

The Brazilian ships *Minas Geraes* type have on either side an internal longitudinal bulkhead 1.5 inches thick at some yards distance from outer skin. This should be the correct practice.

The Argentine ships, *Moreno* class, have similarly a bulkhead 1-inch thick; and, in addition, an inner bottom .7-inch thick at a distance of 13 feet from the outer bottom.

The Russian ships, *Gangoot* class, have only an ordinary longitudinal bulkhead.



Experimentation has established (a) that there is an enormous decrease in explosive effects at an increase of distance from the explosive mass, and we find that the usual charge for a Whitehead torpedo of 220 pounds gives, at a distance of only 59 inches from its surface, but 1/40th of the destructive effect at the surface of the mass; and (b) that under-water explosions are more dangerous *horizontally* and *downward* than vertically and up.

Thus, this most important fact to bear in mind, that an armor plate if used should be placed *not on the outer shell of the ship*, but at *some distance inside*. Thus a plate 59 inches inside the hull is equal in resisting power to one 40 times as thick placed on the outside skin of ship.

Baron Roenne, in the *Journal of the Royal United Service Institution*, proposes a triple bottom. These to be at distances of 33 inches from each other, and the inner to have nickel-steel armor. The space between the bottoms are to be minutely subdivided, and filled with cellulose or some liquid. Naval Constructor S. Nonaka, I. J. N., holds the view that the great weight entailed by this construction is prohibitive; that it would be better to stick to the double bottom only; and also stick to torpedo-nets, and put any extra weight into offensive power.

In the opinion of Mr. Orlando, President of the Italian Institute of Naval Architects, the side of the ship should have little real armor and protection should be placed as near amidships as possible, and the water-tight compartments should be reduced in size.

The water-tight compartments of the double bottom should be filled with corn pith cellulose or other water-excluding material for considerable distances, and trust put in nets, and a body guard of light cruisers and destroyers, together with mine field sweepers, rather than sacrificing gun power or speed in order to put armor of doubtful utility on an inner bottom.

The fact, however, is noteworthy that Germany has reintroduced the torpedo-net protection for her large ships after having been without nets for ten years. Both France and Italy, after having for a time given up nets, now use them. Austria has also now introduced them for her new battleships. Of course Great Britain, Japan and Russia still retain them. The United States has not as yet experimented with the net.

The development of the net-cutting device still goes on, but at present the net is ahead. However, if we include the Davis gun torpedo in our estimate, then the net has possibly met its match already, and net protection must give away to minute subdivision of compartments.

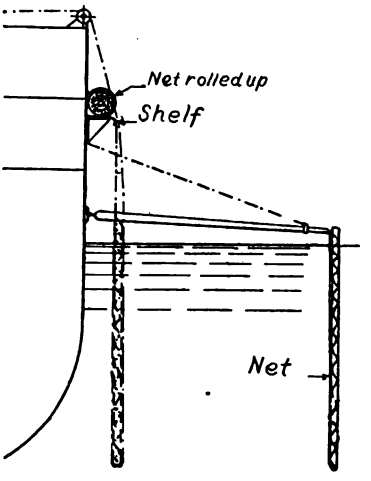
DAVIS TORPEDO.—The *Journal of the Royal United Service Institution* says of this torpedo, that its main defect, the weighting of the head seems to be overcome, but there seems, however, to be no immediate prospect of the introduction of the Davis torpedo in the United States, though its design is based on a sound principle. The reasons for its not being adopted are not known.

The results of the trials of the Davis gun torpedo show that even if stopped by a net it would send its shell through the net, the intervening water, the hull, and a defensive bulkhead right into the vital region.

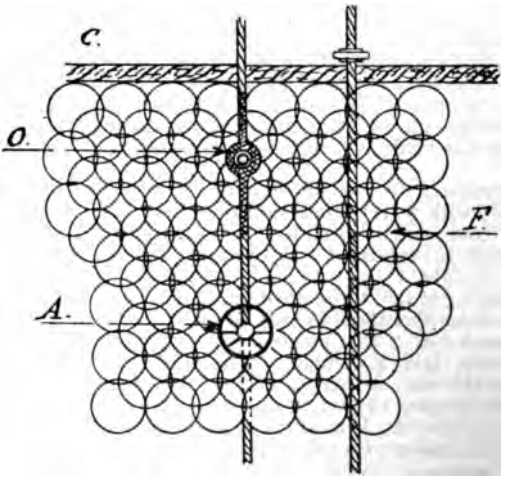
TORPEDO-NETS.—In the German navy estimates for the current year there is an item of £60,000 for torpedo-nets, and an intimation that a further grant for the same purpose will be demanded. This is proof positive that sooner or later all German battleships will be equipped with nets, despite the fierce opposition with which they have been met by a large number of active officers. Before deciding finally on the reintroduction of the "crinoline," the navy office caused experiments to be undertaken to ascertain whether the new type of net could be pierced by any of the numerous cutters which have been patented in this country. The successful resistance offered by the net to this form of attack led to its definite adoption.—*Naval and Military Record.*

TORPEDO-NETS.—The reintroduction of the Bullivant net in the French service has met with general satisfaction. These sketches give an idea of the net, showing the inner and outer one, the junctions in one coming opposite to the openings of the other.

The net protects the vital parts: magazines, engines, boilers. Its depth is about 26 feet. It is supported on each side by 12 booms, each 28 feet long which fit, when net is rolled up, diagonally close to the hull. The ledge for the net is two feet wide. It is worked by special windlasses.



Full lines show nets in place. Dotted lines show net just before it is rolled up.



A = ring for passage of brail.
C = head bolt rope.
F = net.
O = eye of brail.

The time to place or take in a net is at least two minutes. The instal weighs 60 tons. Its cost is about $40,000.—*Moniteur de la Flotte.*

TIME OF HANDLING NETS.—As illustrative of the time required to handle torpedo-nets, the following times in drills in the English Navy at Vigo on March 21, 1912, are given:

Out nets. M.	S.	Battleship.	In nets. M.	S.
2	17	Exmouth	2	5
0	31	Swiftsure	2	7
1	30	Russell	2	7
0	52	Duncan	1	50
2	10	Cornwallis	2	0

THE ELIA MINE.—A very complete description of this mine is to be found in *Engineering* of April 19, 1912. It has recently again come into prominence from the fact that Messrs. Vickers have taken up its exploitation. This system was adopted by the Italian Navy about 1900. Captain Giovanni Emanuele Elia, formerly of that navy, is the inventor. The Dutch, Belgians, and Roumanians have adopted it. The three essentials of a successful mine:

1. Safety in handling;
2. Precision and celerity of laying; and
3. Efficiency in action;

appear accomplished to a remarkable degree.

One firing mechanism depends on action of a ball put in motion when mine is inclined, and releasing thereby a trigger of the firing pin. This ball is locked while handling, and automatically unlocked by a hydrostatic piston arrangement when the mine has reached its depth. Exhaustive trials prove that the firing mechanism is positive, perfectly safe to handle, and thoroughly efficient.

A contact lever system is used where the rise and fall of tide is great to overcome the inherent faults of the hydrostatic device in such waters. This mechanism is inoperative until the immersion of the mine has melted a sal-ammoniac seal. Trials showed that a vessel moving only one knot exploded the mine.

Twin mines, with positive action on principle of a shearing pin, are constructed to prevent the passage of the mine field by small craft.

Precision of laying is shown by the results in laying a series of 63 mines in July, 1911, when the average from the desired depth was but .43 feet. The immersion was made for 10, 3, 16 and 26 feet. The severity of the test is evident.

The worst result in 10 feet immersion was only 6.66 per cent in excess of that desired; with 3 feet immersion the excess was 20 per cent; with 26 feet but 4 per cent; and with 16 feet but 6 per cent. Very remarkable results. The depth arrangement is by means of the automatic anchor, distance line, and weight.

Celerity of laying is said to be great, inasmuch as there are no firing wires or electrical devices this should easily be obtained.

After the smoke of a fast cruiser was sighted on the horizon a mine layer left Naples, laid a complete mine field, and returned before the cruiser reached the mine field, *i. e.*, a mine every quarter of a minute.

The provision adapted to prevent the destroying the mine field by countermining is very scientific. It consists in utilizing the pressure in the water caused by the explosion of a countermine to lock the firing mechanism of the mine until pressure corresponding to depth of immersion again obtains.

FRENCH MINES.—W. H. B.—The French Navy has adopted a most efficient system of mine defences for the harbors of Toulon and Marseilles. The Harlé mine is claimed, after long experiments, to be far superior to those of any other type. These mines are arranged in groups of ten with a common anchor and cables instead of being moored singly. In the group of ten mines each mine is moored automatically 60 meters from every other mine, and they can readily be laid out to form a barrier in very little time.

In the main ship channels they have groups of 50 mines with a 3000 meter long cable. The mines are exploded by mechanical contact. For sea mine defence of a fleet they have adopted a peculiar simple form of mine defence, that consists of a hose of large diameter filled in sections with an explosive that is ignited by water. The mine hose is laid out and being bouyant can be made to float at a fixed depth below the surface as a barrier any distance from the fleet. The enemy on approaching will be enveloped by the hose, water will flow in where the hose will have been ruptured by being torn from its moorings, and the explosion will damage the ship more or less seriously, and will, it is expected, at least cause leaks by starting seams or other strains.—*Internationale Revue ueber die gessamte Armee und Flotten.*

POWDER.

INSPECTION OF POWDER FOR THE FRENCH SERVICE.—In January the French Navy and Army introduced a systematized powder inspection approximating our own very closely. The army and navy will jointly inspect and thus control in the factories, in the central laboratory, in the research laboratory at Sevran, and will also have a central office in Paris. Factories at Pont-de-Buis, Moulin-Blanc, Saint-Médard, Angoulême, Sevran-Livry will have an officer at each. The control of Saint Chamas will be assigned to the inspector in charge of the Toulon magazines.

The sub-inspector service will be 5 men at Pont-de-Buis, 5 at Saint-Médard, 3 at Moulin-Blanc, 3 at Angoulême, 3 at Sevran-Livry.

The laboratory at Sevran will include a director of the work of testing of samples, an inspector, a clerk, and a variable number of assistants. The research laboratory will have an expert head chemist, an ordnance officer, a chemist, and aids. The central office at Paris will have a director, an inspector of manufacture, a navy lieutenant, and a sub-inspector.

The lieutenants detailed for this duty will have a preliminary instruction for three months during which they will reside at Paris, and will learn the practical part in the central laboratory, in the Versailles commission and at the Sevran proving ground. They will follow the manufacture of powder at Sevran and will spend at least ten days there.—*Moniteur de la Flotte.*

STABILITY OF FRENCH POWDER.—Daniel Berthelot, a celebrated chemist, has declared that "Powder B is the best of the war powders actually in existence." This statement he bases on the fact that, exposed to ultra-violet rays, all samples of the other types of powders decomposed more rapidly than the sample of powder B. Laboratory tests, however, are usually on such a small scale that too much reliance should not be placed on the above result. *One* bad grain in the sample would indicate the end of the test quickly, and such small samples do not represent the whole, by any means, and it is therefore possible that the samples of the other powders may have possessed unstable grains, while, by chance, the B sample did not.—*Moniteur de la Flotte.*

EXAMINING FRENCH POWDERS.—At Toulon parties of seamen have been daily engaged, under the direction of a gunnery lieutenant from headquarters, in clearing out the magazines and powder stores, examining their contents, and destroying all powder which fails to meet the tests imposed by the experts. No powder is now allowed to be embarked concerning which there is the slightest suspicion. Some of the ammunition boxes when opened are reported to have contained the strangest ingredients in the way of packing—worn-out powder bags, with grains of black powder still adhering to them, greasy rags, socks, and even an old hat are mentioned! It has been found necessary to alter the method of closing up the ammunition boxes, as their inspection has revealed that drops of acid, caused by the process of soldering down the lids, have found their way into the interior.

The exhaustive tests which have been carried out show that the process of deterioration begins in the center of a grain of powder, and extends gradually to its outside, so that the previous perfunctory examinations have been more or less worthless. It is even suggested that the trouble may eventually be traced to the presence of a microbe, and the Pasteur Institute has been furnished with a number of samples in order to solve the problem. The condemned powder is strewn in a line over a piece of waste ground adjoining the arsenal, a few boxes at a time, and is then ignited. It burns with a long red flame, and the heat is said to be so intense as to be almost unbearable at 20 yards distance. An immense amount of untrustworthy ammunition has been destroyed in this way, and though the "economists" with whom France is also blessed may complain at this sacrifice of costly material, it is unquestionably a cheaper method than to risk another *Liberté* affair.—*Naval and Military Record.*

The 24 cm. charges of the guns of the *Danton* class are all being reworked in the laboratory because during the trial practice deviations from the prescribed weights were revealed. New methods of packing the charges were introduced. All the powder on board ships that was received from the Pont-du-Buis works is subjected to a rigid inspection once every week. No powder can be accepted on board until one per cent of the amount is inspected thoroughly and found to be perfect. They found one charge for a 24-cm. gun on board the *Danton* that gave signs of deterioration.—*Marine Rundschau.*

TARGET PRACTICE.

GERMANY.—German battle practice for 1909-10 figures. The *Hanover* is stated to have scored 18 hits out of 20 rounds from her 11-inch guns, the *Deutschland* is said to have made 12 consecutive hits with her big guns, and the *Schlesien* is credited with 49 hits out of 60 rounds with her secondary armament. Presumably these examples of good gunnery were high above the general average, and it is admitted that the range did not exceed 6000 yards. The truth is that no reliable information about German gunnery is made public, and while the above figures may be approximately correct it is useless to record the performances of a few picked ships.—*Naval and Military Record.*

GREAT BRITAIN.—The Admiralty have just issued the record of results of the gun practice in the navy in 1911, and these must be pronounced as most satisfactory, indicating a high efficiency not only of "the man behind the gun," but also of the ordnance machinery on board. Last year there were a greater number of ships participating in the gunnery tests than for seven or eight years past, the total being 127, as compared with 117 in the three preceding years, consequently a larger number of guns were fired, the total being 1496, as compared with 1318 in the previous year. This number of guns, indeed, is the highest used in the gun tests for the years embraced in the official returns. With these guns 8228 rounds were fired in the tests, and fully half of these were hits. The conditions this year were again altered; ricochets were only counted as three-tenths of a hit, and under these conditions the percentage of hits to rounds fired was 50.01. If the ricochets made last year had been reckoned as whole hits, as was the case in the previous years, the rate would have been 54.86 per cent, which compares with 51.85 per cent in the previous year, 54.12 per cent in 1909, 53.57 per cent in 1908, and 42.70 per cent in 1907. This last was the year when the targets were reduced in size, and the ship's speed, when firing, was increased. But since then the conditions have been made more onerous, because there is now no choice given to the various fleets as to when the battle practice is to take place, so that in some cases the trials have been carried out in unfavorable weather.

The average rate of hits per gun per minute for the 12-inch and 10-inch guns, including all ships of the fleet, is 0.58. The best performance of any

ship for the 12-inch guns was 2.31 hits per minute, by the battleship *Russell*, in the Mediterranean fleet. The next ship is the *Queen*, with 2.07 hits per minute; the *Britannia* coming third with 2.04; then follow the *Venerable* and *Implacable*. The first *Dreadnought* on the list is sixth, the *Superb*, with a record of 1.76 hits. This must be reckoned as a good result. In other words, within the given time, 17 direct hits were recorded, in addition to four ricochets; whereas the first two ships on the list, the *Russell* and the *Queen*, fired together 31 shots, resulting in 16 hits and two ricochets. The seventh on the list is the *Neptune*, also a *Dreadnought*, which has 1.71 hits per minute.

The best performance for the 10-inch breech-loading gun was 1.67 hits per minute, while in the case of the various types of 9.2-inch guns the hits per minute were 3.34, 4.19 and 2.53, while the average for the whole fleet was 1.90. It would appear, therefore, that, on an average performance, the rate of fire of the 9.2-inch gun on last year's showing is three times greater than that of the 12-inch gun; but this is probably accounted for by the rule that the larger number of 12-inch guns fired, as compared with 9.2-inch guns, tends to bring down the average. The best performances of the guns of the two calibers indicate that the 12-inch gun may be equal to something like 60 or 70 per cent of the rapidity of fire of the 9.2-inch gun. The 7.5-inch gun achieved a rapidity of hits per minute of 5.53 in the best ship, and of 2.78 on an average.

There are various marks of 6-inch gun in use; the average performance for all of these marks in all ships is 3.89 hits per minute. In the latest gun, of the breech-loading type, the best attained was 6.33, in one of the new *Town* class of cruisers, the *Glasgow*. The earlier mark was equally satisfactory, and showed a greater uniformity. With a 6-inch quick-firer, one of the China ships—the *Flora*—achieved 6.82 hits per minute. The results in other ships range down to 1.50; no doubt there is some explanation why one ship should only attain 20 per cent of the hits achieved by another ship of practically the same class. The *Flora* also achieved first place with her 4.7-inch guns, the rate of hits being 5.88 per minute. In the case of the 4-inch gun the best performance is 7.43 hits. It is notable, too, that the battle-cruisers that were fitted with this gun as a torpedo-boat repeller have all come out well, the *Inflexible* having got 7.30, the *Invincible* 6.75, and the *Indomitable* 5.35 hits per minute.—*Engineering*.

In the British Navy too much latitude is given to our admirals and captains in the matter of weather. Occasionally a ship may carry out her practice in a seaway, but we believe this to be exceptional. Fine weather is naturally chosen because the Admiralty are known to attach much importance to the results of these annual competitions. Every captain desires that his gunners shall acquit themselves with credit, while the promotion of gunnery lieutenants hangs upon the results of battle practice. The superior shooting of our gunners on the Australia and China stations is mainly due to atmospheric conditions. On all stations there should be gunnery practice both in fine and bad weather.—*Naval and Military Record*.

MARINE ENGINEERING.

COLLIER "NEPTUNE."—In July, 1911, the United States collier *Neptune*, after having undergone her official speed trials, was temporarily taken over by the government, subject however, to the subsequent fulfillment of contract requirements.

According to contract, an average speed of 14 knots was to be maintained on a continuous 48-hour trial, and the coal consumption for all purposes was not to exceed 1.8 pounds per indicated horse-power per hour, figured on the power developed by the main engines. At the trials referred to the average speed obtained was 12.926 knots, the collective brake horse-power of turbines 5409, or the equivalent indicated horse-power 5879, and the coal consumption 1.791 pounds per indicated horse-power per hour.

The unsatisfactory results were attributed mainly to very inefficient screw propellers, and possibly to inadequacy of the turbines. It will be recalled in this connection that the ship in question is fitted with a mechanical reduction gear, as finally adopted by the Westinghouse Machine Company, operating in conjunction with a new type of Westinghouse marine steam turbine. As a preliminary step, with a view to remedying the failure in fulfilling the requirements, it was decided to make new screw propellers, which were laid down by the Bureau of Steam Engineering, Navy Department, from a design directed by Captain C. W. Dyson, U. S. N. In the trials performed recently with the new propellers the results obtained were most satisfactory, both as to speed and coal consumption. The principal differences between old and new propellers will be found in the comparison appended below:

	Old Propellers	New Propellers
Type	Built Up	Solid
Number of blades	4	3
Diameter	14 ft. 6 in.	14 ft. 8 in.
Pitch	12 ft. 6 in.	12 ft. 1 in.
Projected blade area	61 sq. ft.	50.68 sq. ft.
Trial results	Old Propellers	New Propellers
Speed	12.926 knots	14 knots
Revolutions per minute	119.5	131.7
Coal consumption per I. H. P. per hour, turbines only	1.791 lbs.	1.63 lbs.
Shaft horse-power	5,409	5,980

Maximum speed attained with new propellers was 14.24 knots, with a corresponding shaft horse-power of 6310. The propulsive efficiency figures out about 65.6 per cent. The higher number of revolutions per minute with the propellers aided materially in enhancing the steam economy of the turbines, and therefore a reduction in coal per horse-power.—*International Marine Engineering.*

INSTALLATIONS OF RECIPROCATING ENGINES AND TURBINES.—The installation of the destroyer *Henley*, launched on April 3, 1912, comprises a 63-inch, 18-stage Curtis marine turbine, to the forward end of which is connected, by means of a clutch, a compound reciprocating engine. This installation was tested in December, 1911, at the Fore River Works, and showed the following improvement:

Per cent Improvement of Combination over Turbine.

Actual.	Corrected to 28.5" Vacuum.	Corrected to Same Vacuum and Steam Cond.	
....	....	....	Turbine—10 knots
48.1	48.9	49.9	Combination
....	....	....	Turbine—13 knots
38.3	37.2	39.9	Combination
....	....	....	Turbine—16 knots
26.0	24.7	24.8	Combination—Some live steam in turbine
34.6	34.2	....	Compound—all steam in engine

—*International Marine Engineering.*

England is building a twin-screw destroyer driven by turbines for high speeds, and by internal combustion engines at cruising speeds.

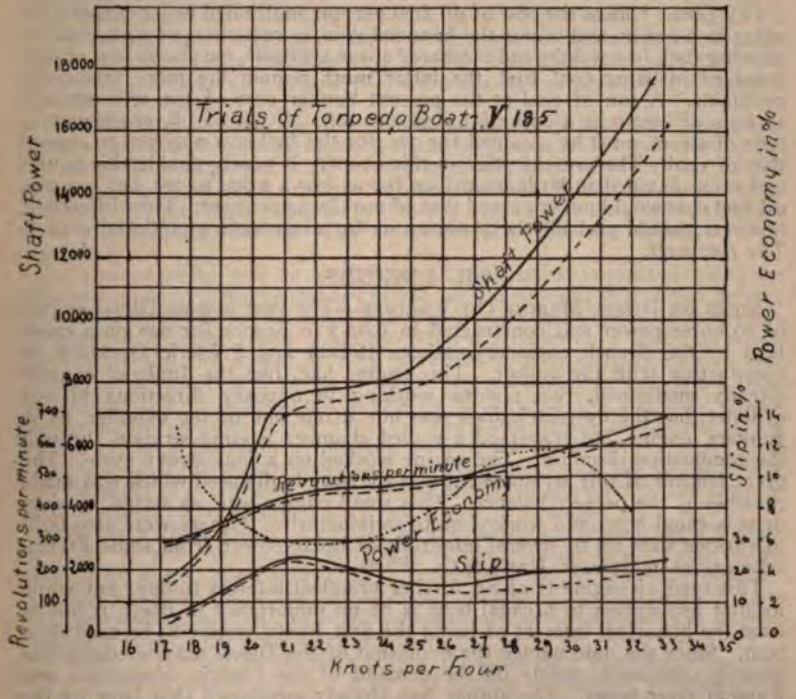
SUPERHEATED STEAM.—The saving by its use is about 8 to 10 per cent in fuel consumption, and 10 to 12 per cent in steam consumption, a superheated

temperature of 100° F. being used. The usual objections, need of oil for internal lubrication, and likelihood of burning the superheater when passage of steam through it is suddenly reduced, are now overcome, the former by use of turbines, and the latter by the Yarrow superheater. The trials of the destroyer, H. M. S. *Archer*, fitted with the above installation, showed the saving indicated above.

PROPELLERS WITH FIXED BLADES IN REAR.—Trials have been made with these in Germany, with the torpedo-boat *V-185*. Great care was taken in the trials, and the chart herewith shows the result.

V-185 is a destroyer, twin screws, with horse-power of 16,000.

The full lines indicate the results with the fixed vanes or directrix, the dotted without.



At the high speeds the benefit of the fixed blades is very marked. It represents nearly 2000 horse-power at 32 knots.

OIL FUEL.—Two-thirds of the world's present oil supply comes from the United States, the majority being Californian, Russia supplies 24 per cent, the remaining 10 per cent being very widely distributed over about fifteen different countries. The total production of oil in 1905, the year when oil fuel alone was adopted for certain of H. M. ships, was about 37,000,000 tons; in 1911 it was nearly 53,000,000 tons. For United States oil fuel, as used in Europe, a calorific value of 19,400 B. Th. U.'s per pound is a fair average, giving an equivalent evaporation from and at 212° F. of 20.1 pounds of water. The cost in England is now about one-half of what it was five years The tendency for the sources of supply to increase is still accompanie slight reduction in cost per ton.

The two principal objections to the use of oil fuel are:

(1) Uncertainty of supply. The United States is in a very strong position in regard to oil fuel, and the decision of the United States Navy Department to instal an oil-burning system only in their last two battleships is very significant; the potential advantages of doing so are greater for them than for anyone else. Oil-burning European liners would require to take in fuel on the American side, and the certainty of being able to do so is perhaps rather doubtful, compared with the United States Navy supply. A number of large fast liners burning oil would make a serious inroad into the world's production as it stands at present. For instance, ten large Atlantic liners, each burning 40 tons per hour on fifteen round trips a year of 120 hours each way, would require 3 per cent of the world's present output. The question of the site and cost of storage plant in close proximity to the liner's docks are other matters of considerable difficulty.

(2) Cost. Unless the cost of oil fuel per ton, multiplied by its evaporative value in a boiler, and minus the financial gain in reduction of staff, cost of stowing fuel, less weight and increased space available, etc., be as low as that involved in using coal fuel, the latter must remain the more financially profitable. A ton of coal at the present bunker cost of 16s. will produce 11 tons of steam at a cost of 1.453s. per ton. A ton of oil, producing 15 tons of steam, must be obtained for 22s. for the fuel cost only not to exceed that of coal. The present price in this country is nearly double this figure, and even obtained in large quantities for as low a price as 30s. per ton, the oil fuel cost would never exceed that of coal by 33 per cent. This difference, however, would probably be made up in the advantages of reduced staff.—*The Engineer.*

OIL ENGINES.

NOTES ON DIESEL MARINE OIL ENGINES.—The first marine Diesel engine of 20 horse-power was constructed in 1902-3 in France for use on a canal boat by the French engineers, Adrien Bochet and Frédéric Dyckhoff, in conjunction with the author. This engine had, like the Junkers' engines already mentioned, two pistons working in opposite directions in one cylinder, but the fly-wheel shaft was not at one end of the cylinder, as in Junkers' engine, but traversed a cooled chamber passing straight through the combustion chamber. The engine worked on a four-stroke cycle. The great feature of this arrangement was the very high speed which was made possible by the perfect balance. This small engine was, as stated, used to drive a canal boat, and worked quite satisfactorily. Others were also built in various sizes up to several hundreds of horse-power from some French submarines by Sautter, Harlé & Co., Paris.

This type of engine is of no further practical interest to-day; but while its first application to a canal boat is of no importance in itself, it has at least the historical interest of being the first Diesel engine to be used on a boat. Since the date named the evolution of the Diesel marine engine has steadily continued, chiefly on the demand of the French submarines and Russian river boats. The author has already mentioned that later on the high-speed four-stroke cycle engines, built for electric power stations, were made even lighter than before, and used for French submarines and for Russian river vessels. These engines were not originally reversible; on the contrary, they were used to generate electricity, by means of which the propellers were driven indirectly for maneuvering. In the most favorable case (Delproposto) the propulsion of the vessel was performed directly by the engine, whilst the maneuvering and slow driving were done by means of electricity.

The first reversing marine two-stroke cycle Diesel engine was built in 1905 by Sulzer Brothers, at Winterthur; it was exhibited in 1906 at Milan, and fiitted to a vessel on Lake Geneva in the same year. At that time engineers were not quite clear as to the importance and value of the two-stroke cycle principle, and many firms went on trying for years to make the four-stroke cycle engine reversible. The first engine of this kind was

built by Nobel Brothers, at St. Petersburg, in the year 1908, and was fitted to a Russian submarine.

In many factories reversible four-stroke cycle marine engines are still built, but, on the whole, engineers are, for navigation purposes, inclined to abandon the four-stroke cycle engine entirely and to replace it by the two-stroke cycle engine.

The small four-cylinder engine of 30 horse-power and 600 revolutions per minute is also a reversible four-stroke cycle engine. It was built for experimental purposes in the year 1909, after designs by the author, as an automobile engine for heavy loads, but it can also easily work as a marine engine. The cam shaft is mounted on the cylinder cover.

It is generally known, however, that in the Nürnberg works of the M. A. N. important experiments with large double-acting two-stroke cycle engines are being carried out.

In these works prolonged official tests of a three-cylinder double-acting two-cycle engine of 850 horse-power were made in August, 1911, and the results proved highly satisfactory. At the present time a double-acting two-cycle three-cylinder engine of 2000 horse-power per cylinder is being tested at Nürnberg.

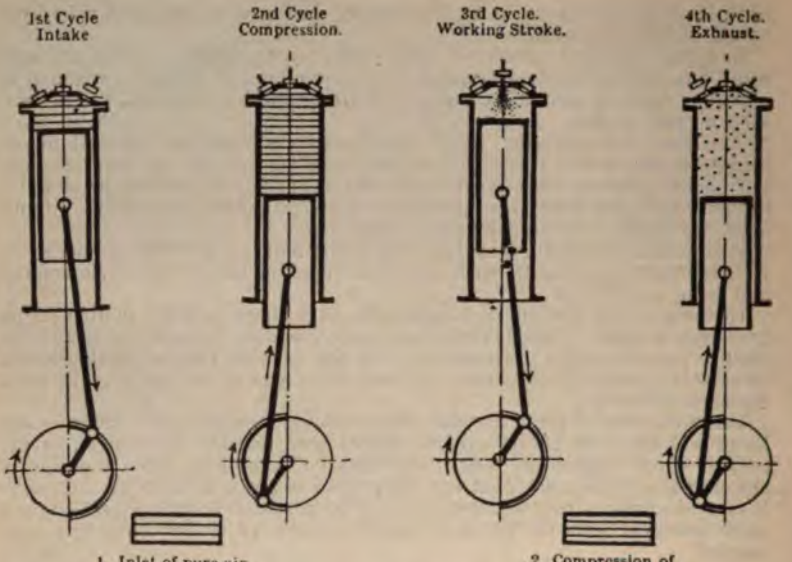
From motives of prudence, the various navies which are now fitting some large warship with Diesel engines started with one Diesel only out of the two or three engines on board; the Diesel works alone when the ship is running at normal speed, but for high speed steam is used as an auxiliary. It is evident that larger warships will not be fitted solely with Diesel engines until practical tests on the high seas have proved to be completely successful.

Conclusions.—As will be seen from this historical summary, countless different types of Diesel engines have so been developed that it has become very difficult for even the expert to choose between them. If one looks through the technical press, numerous other schemes will be found on which the author will not dwell, as they have never been actually carried out. To-day, if a new firm is about to manufacture Diesel engines, it is almost impossible to give them sound advice as to the type and size they should choose from this bewildering variety. The fads, habits, and tastes of the purchasers, and the kinds of machine tools in use in the works, have to be taken into consideration rather than technical points of the engine itself. Development is proceeding so rapidly at present that within a few months opinions even on important points may easily be changed.

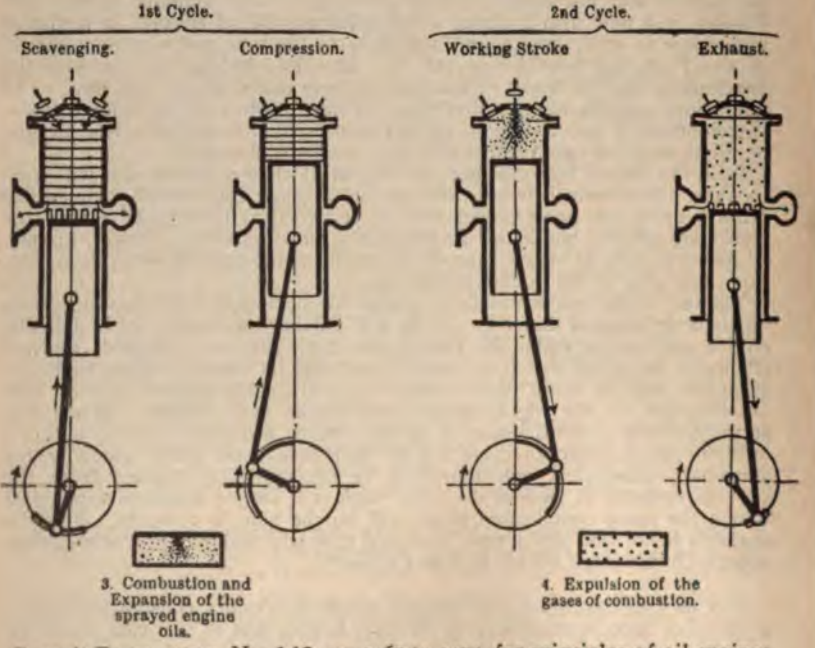
Still, the author believes that this period of chaotic production will soon be over. At present it is generally agreed that the four-stroke cycle engine from 5 up to 600 horse-power may be regarded as the exclusive type for stationary plants; but it will probably not remain so much longer, in spite of its perfection, in view of the development of the two-stroke cycle engine, especially that of the double-acting type.

The use of the two-stroke cycle engine for stationary work has increased, but it is anticipated that this will be still further extended. Although this engine may never equal the four-stroke cycle engine as regards thermal efficiency, its initial cost is so much lower that its slightly higher fuel consumption will be more than counterbalanced by the greater interest and amortisation on the higher-priced four-stroke cycle engine. When this stage is reached, the question is simply one of economy. In the author's opinion, the two-stroke cycle engine will thus soon make headway for stationary plants. It will therefore be necessary to produce from the various systems of two-stroke cycle engines a simple standard type, with which the more complicated types will not be able to compete. It is the author's belief that this simple standard type will make its appearance very soon.—Dr. Rudolph Diesel, in *The Engineer*.

SIZE OF OIL ENGINES.—The biggest installation under construction is for a vessel of 3500 horse-power by Messrs. Krupp, and in this case there are 12 two-stroke cycle cylinders of 22.45-inch diameter, and stroke of 39.4



SINGLE-ACTING DIESEL ENGINE, FOUR-STROKE CYCLE.

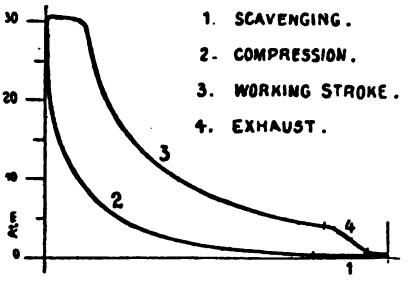


Consult PROCEEDINGS, No. **140**, pp. 1467 to 1474, for principles of oil engines.

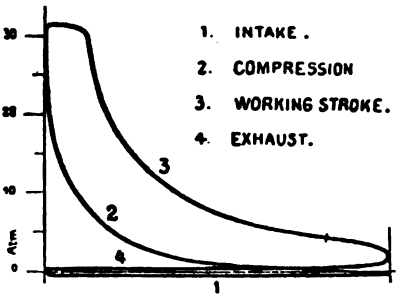
inches. One is in contemplation of 6000 horse-power with 24 four-stroke cycle cylinders of 24.8-inch diameter and stroke of 31.5 inches.

Cargo boats fitted with Diesel motors of 800 to 1000 horse-power have given excellent results and the 2500 horse-power installation on the Danish ship *Selandia*, which has just begun service, is said to have answered all expectations during the recent trials. When, however, we come to installations of 12,000 to 15,000 horse-power for high-speed warships, the conditions are quite different. The Krupps obtained some time ago an order from the German Navy for Diesel motors of high power and so far experiments with these engines have resulted in two explosions, the second one killing eight men and wounding eight more. Diesel motors would solve

Two-stroke Cycle.



Four-stroke Cycle.



INDICATOR DIAGRAMS OF SINGLE-ACTING DIESEL ENGINES.

one of the most delicate naval engineering problems by allowing an enormous saving in weight, besides their great economy in fuel consumption, which would also reduce the bunker capacity for a given radius of action. However, the last catastrophe has revealed the dangerous character of these engines at such enormous pressures as would be required on battleships and cruisers and it seems as if many years would elapse before their employment became practical even in high-speed passenger liners.—*Shipping*, Illustrated.

Two Russian cruisers, each 266 feet 8 inches long by 42 feet 2 inches beam, of about 3500 tons net and [illegible] horse-power, have been fitted with Diesel engines by one of t[illegible]ine builders in that country. This firm has also [illegible] for five 1000-horse-

power gunboats, one 900-horse-power gunboat, one 750-horse-power government inspection ship, together with other craft, which brings the total up to 90 ships aggregating 20,000 horse-power.—*International Marine Engineering.*

OUR FIRST DIESEL-ENGINE SUBMARINES.—Our two latest submarines, *E-1* and *E-2*, have two features of novelty, namely, that the motive power consists of Diesel engines, of 520 horse-power, and that the vessels are fitted with a form of folding masts, which reach 30 feet above the deck and will form part of a wireless outfit. The vessels are 135 feet long and each carries four torpedo-tubes. As 5000 gallons of fuel oil can be stored, the vessels will have a wide radius of action.—*Scientific American.*

For submarines the oil engine possesses the advantages, that it is reversible, and that the fuel is not so dangerous to carry as gasolene.

OIL ENGINED VESSELS.—The Dutch steamship *Sembilan*, of 152 feet length, beam of 26 feet, has Werkspoor-Diesel engines, three cylinders, each 12 inches in diameter with stroke of 20 inches. Speed of 200 revolutions per minute. Oil consumption, one ton per 24 hours. Has made a run of 1780 miles at mean speed of 7½ knots on consumption of 14 tons of oil. The average consumption being 11.7 pounds per sea mile.

Time from full speed ahead to full astern is 7 seconds, the engine itself reversing. This vessel is in the Java trade.

The *Vulcanus* has proven a success. Her displacement being 1900 tons, with a 500 horse-power Diesel oil engine.

OIL-ENGINED SHIP "SELANDIA."—This is the first sea-going passenger vessel fitted with Diesel engines, 2500 horse-power, and is for the East Asiatic Company. There are two engines, driving twin screws, each engine consisting of a set of eight single-acting cylinders 20⅞ inches in diameter by 28¾-inch stroke, working on the four-stroke cycle. Messrs. Burmeister & Wain have adopted this type of Diesel engine to obtain greater reliability, owing to the absence of temperature troubles, the completeness of scavenging, and the better balance of the reciprocating parts than has so far been considered obtainable with two-stroke cycle engines of equal power and of the same cylinder dimensions. That this policy is justified was proved by the running of the engines on the demonstration trip from London to Antwerp.

The cam shaft and maneuvering shaft are supported on brackets bolted to the crank case, making the removal of the cylinder heads for the examination and adjustment of the reciprocating parts quite simple, as neither of these two shafts need be disturbed in any way. Skew gearing—the most general method of drive for the cam shaft—has in this design been displaced by cast-steel spur wheels, although it is retained for the maneuvering shaft, which is only in action to bring the opposite motion cams into play, to lift the rollers with their push rods and to replace them. The skew gearing is operated by a compressed-air motor taking air from the starting air reservoirs. There are two fuel pumps for each set of eight cylinders, each pump being of sufficient capacity to supply the whole engine, and, according to the gauge, the pressure of the oil on the exit from the pump was 1000 pounds per square inch. This gives an indication of the extreme accuracy of machining and fitting which is essential for this work.

A fourth-stage compressor in the forward end of each main engine receives the air from the 300-pound compressor, and compresses it up to the pressure required for the injection and pulverization of the fuel—*i. e.*, 900 pounds per square inch. Each one of these high-pressure compressors is equal to the total work of both engines, and, further, an additional length of working stroke can be given to either when it is desired to increase the

output of 900 pounds per square inch air for the recharging of bottles, etc. It is also further possible to fit a delivery valve with connections to a working cylinder in place of the exhaust valve, so as to augment further the store of the starting medium, by utilizing the compression stroke of the cylinder. The engine turns well, and without appreciable loss of balance when firing in seven or even six of the cylinders of one engine. As a final stand-by, a steam-driven three-stage 900-pound per square inch air compressor is installed forward of the oil-fired donkey boiler which is placed aft in the engine room between the thrust shafts.

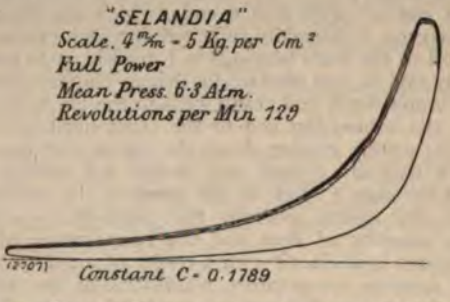
The fuel injection air is stored in two working bottles of German manufacture, with solid ends welded in by a patent process, placed vertically amidships between the compressed-air maneuvering engines. Drain pipes to the bottom of the working bottles are fitted, and periodic blowing down ensures freedom from moisture, with its consequent corrosion. Two spare bottles are placed against the forward bulkhead, and it is so arranged that connections can be made between the independent fuel injectors, one working and two spare air bottles, to keep the main engines running should their air supply fail, due to leakage, etc. It is interesting to note that both the auxiliary Diesel engines have also a fourth-stage air compressor (300 pounds to 900 pounds per square inch) on the forward end of their crank shafts. The starting air, at 300 pounds per square inch, is stored in four reservoirs —two for each engine—with dished ends, which are hung from the deck above. One reservoir is normally sufficient for each engine.

Lubrication oil to the main bearings is forced in at 10 pounds per square inch pressure by one of two electrically driven plunger pumps through the main bearings, crank shaft, and crank webs to the pin and bottom end bearing, thence up the connecting rod to the cross head bearing and up the piston rod to the piston, coming down the piston rod again to the guides, when the oil is partially cooled, and thence led outside the crank case and discharged through a filter to the sump in the bed plate. This discharge supplies the means whereby the engineer on watch can assure himself of the quantity of flow and the temperature of the oil. Each lubricating oil pump is in circuit with a cooler of ample proportions to cope fully with the onerous temperature conditions of the Red Sea and the tropics. There are two cooling-water centrifugal pumps, electrically driven, to supply all the cooling for the main and auxiliary engines, main and auxiliary compressors, lubricating oil, etc.; two duplicate electrically driven three-throw plunger pumps, one for sanitary purposes, two for the bilges, with connections to the ballast tanks, which are usually pumped out by a compressed-air-driven ballast pump. The compressed air also operates the fuel-oil pumps, which draw the fuel oil from the double-bottom tanks to two daily service tanks of sufficient capacity for 12 hours working, which are placed on the engine-room tops. The function of these service tanks is to permit of the settlement of any water pumped, together with the oil from the double-bottom tanks, which are filled with ballast when empty.

The donkey-boiler auxiliaries, the fuel-oil heater, feed pump, and fuel-oil pump are naturally steam driven, and are placed in the after bulkheads, and there is an electrically driven CO_2 machine, used for the refrigerating space. The electric hydraulic steering gear of the Hele-Shaw-Martineau type has given every satisfaction.

It is interesting to note that compressed air will not be used for working the ballast and fuel-oil pumps in the next ship, as it has been found that the method of drive is neither reliable nor economical for these purposes. A critical examination of the machinery equipment of the *Selandia* reveals the fact that Messrs. Burmeister & Wain are determined to show in actual practice that the prejudice of the many sceptics is unfounded, and that where first cost and weight are not primary consideration, an installation can be designed which will meet the most stringent demand for reliability.

Below is a reproduction of an indicator diagram taken during the voyage of the *Selandia*. The mean effective pressure from the card is approximately 6.4 kg. per cm. (91 pounds per square inch) at 129 revolutions per minute, which gives the indicated horse-power for eight cylinders at 1190, or 1000 brake horse-power, assuming 84 per cent mechanical efficiency, as obtained on the test bed at the Copenhagen works. The fuel-oil consumption is about 0.45 pound per brake horse-power hour. The space in which the silencers, cooled by the feed for the donkey boiler, were placed was noticed to be hot, and it is problematical whether a mast exhaust possesses any advantages other than that of appearance over a water-cooled silencer in a funnel above the engine room. There was less smell in the engine room than in that of a steamship. The noise from the engines, what little there was, is attributable in a considerable measure to the delivery valves of the 300-pound per square inch air compressors and the lubricating oil pumps, which, latter, it must be explained, were designed and made within one week, in order to take the place of compressed-air pumps, which had not proved entirely satisfactory. The fact that the engines were of the eight-cylinder eight-crank type gave a remarkable freedom from that vibration usually associated with Diesel engines, but, as in many other ships, the synchronism of the periods of vibration at certain speeds made itself felt to those in the passenger accommodation.



The engine-room officers will number seven—two on each watch. It is, moreover, claimed that the adoption of Diesel engines has increased the cargo-carrying capacity by 1000 tons, chiefly owing to the absence of coal bunkers, since an engine and boiler room for the same power would only occupy two or three frame spaces more than the Diesel engines. The saving in weight must be small, since the machinery of the *Selandia* must weigh some 400 to 450 tons, which is equal to 250 pounds per brake horse-power for the main engines alone.

The *Selandia* has not yet encountered weather of a sufficiently severe nature to test the action of the Aspinall governor to prevent racing of the propeller, although it is stated that the governor gave satisfaction on the test bed when the dynamo load was suddenly cut off. Another interesting point will be the effect of the flywheel on reimmersion of the propeller after the governor has been in action. The maneuvering capacity of the engine was tested from West India docks to Gravesend, and proved satisfactory, although two tugs were in attendance.—*Engineering.*

The large Diesel motors built by the Maschinenfabrik Augsburg-Nurnberg, Nuremburg, for the German Navy, do not seem to have given entire satisfaction. Several months ago the cylinder of one of these motors exploded in the builders' shops. After various modifications new trials took place, resulting on January 30, in a deplorable disaster. After the motor had been going at full speed for several hours, a cylinder exploded killing three machinists on the spot and wounding mortally five more engineers and machinists who all died before morning. Furthermore, two engineers and

six workmen were seriously injured. A sequel to these accidents is that the opinion is gaining ground among engineers that high-powered Nuremburg Diesel motors upon which such hopes had been built will never be installed in the large battleships for which they were intended.—*Shipping*, Illustrated.

ADVANTAGES OF OIL-BURNING VESSELS.—The East Asiatic Company, owners of the S. S. *Selandia*, claims the following advantages for oil-burning vessels:

(1) The savings effected by using oil instead of coal may, under the oil contract made by the company over a series of years, be estimated at more than 50 per cent. (2) The increased loading capacity obtained through less weight of machinery, as well as increased cargo space gained by the absence of coal bunkers, and larger carrying capacity owing to difference in the respective weight of quantities of oil and coal. (3) Calling at ports for filling bunkers and loss of time connected therewith are avoided. A steamship on the Far Eastern trade will require to coal at eight or ten different ports, whereas a motor vessel need only take in oil at one or two ports. Further, the drawbacks attending coaling and stoking are got rid of; savings are in this way effected and expenses for maintenance reduced. Moreover, there is no heating of the vessel from the boilers, which, particularly in the tropics, is of great importance to the cargo, and also the danger of spontaneous combustion is diminished. (4) The cost price of a motor ship like the *Selandia* is about 10 per cent higher than that of a corresponding steamship, but on the other hand the loading capacity is larger by about 10 per cent, so that the gain per ton-carrying capacity will amount to about the same.—*The Engineer*.

OIL-ENGINED VESSELS IN SERVICE.—The following table from *The Engineer* gives list of these in service in April, 1912:

Summary.

Oil-tank vessels (15,000 tons, 42 H. P. largest)	about	21
Tugs	"	37
Motor sailing vessels	"	8
Merchant vessels, freight, passenger and combined vessels (9000 tons, max. 3000 H. P)	"	43
Fishing boats	"	14
Miscellaneous	"	16
Submarines	"	115
Warships	"	30
Small boats	"	20
Total		304

DIESEL OIL ENGINES IN ELECTRICAL PLANTS.—In general, the reports seem to indicate that the most serious troubles and the principal sources of expense in connection with the operation of the engines (most of which had been used from one to three years) were due to cracked cylinder heads, broken connecting rods and crank shafts, to reboring of cylinders, to carbon deposits and valve grinding, and to replacement of piston rings and fuel injection accessories, valves, needles, atomizers, etc. Cost of repairs per engine per year varied from a nominal sum up to one instance of $700, the latter high figure being mainly due to cracked cylinder heads. The average cost of repairs and renewals was between $200 and $300 per engine per year, or from 2 to 3 per cent of the cost of the engines.—*Electrical World*.

GAS ENGINES FOR SHIP PROPULSION.—*The Holzapfel II.*—This is a gas engined vessel, with its own gas plant, which was built and supplied by the Power Gas Corporation, of Stockton-on-Tees. It consists of two producers, 3 feet 6 inches square and 6 feet 6 inches high, and of two scrubbers, 13 feet

high and 2 feet 6 inches diameter. Exigencies of space on board so small a vessel forced the owners to agree to a somewhat cramped position for the gas plant, which is situated in the engine room on the port side. The arrangement as it exists on board this vessel is probably the only one, so far as the producers are concerned, which could be adopted on a vessel of her size with engines aft.

These are placed on a platform 3 feet 9 inches high, and they form part of a closed-in gas space, which is accessible by a gas-tight door from the engine room, but is not supposed to be entered, except in case of urgent need, while the vessel is under power. The working of the producers, such as blowing on, and the working of coal cocks is by levers from the engine room. The only openings to the engine room are the blowing-on cocks, which can be shut by a slide, and four inlets, which are only open while the gas plant is under suction.

The producers are lined inside with fire bricks; they were originally connected with the scrubbers by horizontal pipes entering the scrubbers at the base. The scrubbers were filled with coke to a depth of 6 feet; sea water from a tank on deck trickles down through this coke, and serves to cool the gas and to free it from any dust which may enter from the producers. Above the coke is a space containing wood wool as a further means of cleaning the gas. The cooling water is discharged into a tank underneath the scrubbers, whence it is pumped overboard by a drum pump running by a belt from the main engine. Originally a centrifugal pump was fitted for this purpose, but it was found to be quite useless, and had to be changed for a drum pump. Steam vapor is supplied by eight flash boilers inside the producers, and fresh water has to be supplied for this purpose, and this is carried in the after peak tank. In order to be able to use sea water, a new type of vaporizer has been designed, by which sea water can freely be used, and this will be fitted to the exhaust in the early future.

It may here be stated that a sufficient supply of steam vapor, *i. e.*, 1 pound of water evaporated for every pound of coal used is essential, not only for the quality of the gas, but also to reduce the formation of slag in the producers.

The vertical gas engines is by Messrs. E. S. Hindley & Sons, of Bourton, Dorset. It has six cylinders, 10-inch diameter and 10-inch stroke; it is designed to run at 450 revolutions per minute. It is a similar engine to the type now manufactured by several gas engine builders for the purpose of working electric dynamos, and, in so far as it works on the hydraulic transformer, its task is practically identical with that of other vertical gas engines on shore. The engine has forced lubrication and low-tension magneto, and also Lodge ignition.

The consumption of anthracite coal during recent runs varied between 25 and 35 cwt. per day of twenty-four hours, and was about one-half of that of steamers of similar power.

During this period several faults manifested themselves in connection with the machinery, and particularly with the gas plant. Among them it should be mentioned that the horizontal connecting pipes between scrubbers and producers several times got filled with water when the ship was by the stern, which shut off the gas from the engine and caused a sudden stoppage. As a consequence, this pipe was altered so as to slant downwards from the producers to the scrubbers.

The coke in the scrubbers, moreover, was found to gradually pulverize, and it ultimately choked the outlet, so that the water rose, and even came into the producers, putting out the fires. Since that time earthenware tubes of a design giving a maximum of surface have been placed in the scrubbers as a substitute for the coke.

The fire-brick lining of the producers was frequently covered with slag, and when this was removed the fire bricks were injured. I have suggested that interlocking blocks of steatite would be a good substitute for fire brick, as I am of opinion that slag will not adhere to this, and an experiment for putting a partial steatite lining into one of the producers is now being made.

The two levers for opening the exhaust valves of the producers were originally on the port side of the engine. It happened several times that in cases of sudden stoppage of the engine burning gas came from the producers into the engine room, when it was difficult, on account of the gas flame, to get at the levers of the exhaust valves. In order to avoid this, the shafts of the exhaust valves have been brought right across the engine to the starboard side, and so arranged that both valves can be opened by one movement. I consider it essential that such or similar arrangements should be fitted to future gas-driven vessels.

The Lodge ignition, as originally fitted, and having wax as an insulating material, was found unsuitable on account of the high temperature prevailing in the engine room, and a new design of ignition specially adapted for the vessel is now being fitted.

Another interruption in the working of the vessel was caused by the shifting and breakage of one of the oil pressure pipes. This happened at a very inconvenient time, in very heavy weather, and caused some danger to the vessel. The oil pressure pipes are now being placed in deep grooves, and very securely fixed into position so as to preclude the possibility of a similar accident.

In other respects the gas engine has worked with fair regularity, but the power given with anthracite gas is probably nearer 160 than 180 horsepower, the power guaranteed by builders, which guarantee, however, was for gas of 140 B. Th. U. The transformer has been in every way satisfactory.—*The Engineer.*

AERONAUTICS.

For the first time an Italian aeroplane has been touched by the enemy's fire. While the airman Rossi passed over a large Arab encampment in the vicinity of Tobruk carrying as a passenger Captain Montu, who succeeded in throwing bombs with good result, the aeroplane was fired upon by the enemy and was hit by four bullets, one of which wounded Captain Montu very slightly. Captain Montu is a member of the Chamber of Deputies and went to Tripoli to organize a corps of volunteer airmen.—*United Service Gazette.*

The use of the dirigible as a weapon of offensive warfare was tried with apparent success by the Italians at Aziziah in Tripoli on May 2, when, according to a terse official report sent to Rome, two of the new dirigibles sailed over the camp and dropped thirty bombs, practically destroying the enemy's position, and resulting in heavy loss of life. The Turks tried to utilize their field pieces to destroy the dirigibles with shrapnel, but they could not fire at sufficient elevation, and the explosives fell far short.—*Army and Navy Journal.*

AERONAUTICS IN FRANCE.—The latest figures with regard to aviation and aeronautics in France are $4,800,000 for aeroplanes and $1,600,000 for airships. Fifteen of the latter type will be constructed, and at the end of 1912 it is proposed to have 334 aeroplanes in operation. At the present time the French Army has over two hundred. These aeroplanes, which are known as avions, are to be divided into flotillas of eight machines, six of which are to be always in full commission with two in reserve. These six machines are to consist of two monoplanes and four biplanes, divided into pairs and intended to carry one, two, and several men. The reserve machines are to be one monoplane and one biplane. The 208 avions now possessed by the army have been divided into thirteen flotillas, eight for field and five for garrison use. At the end of the year it is expected to have twenty-seven flotillas in the field and five for garrison work. A special flotilla of powerful high-speed machines will be attached to each of the field armies in time of war, for long distance reconnoissance work. Each flotilla is to have seven pilots, a quartermaster, four non-commissioned officers (including a chief engineer), and forty-four men.—*Scientific American.*

Progress in aviation matters is a commendable feature of the French fighting administration. The advance made by the army is now being emulated in the navy, the Minister of Marine having decided to use the Montpellier aerodrome for the trial of hydroplanes and the training of naval airmen. At present, the French Navy has an aeroplane at Buc, and a Voisin hydroplane is on order which will begin its trials at Toulon on April 15. The cruiser *Foudre* has been specially prepared for aviation work and has been fitted with a platform for the landing of aeroplanes. The Montpellier aerodrome will only be used provisionally until that of Fréjus, which will be the headquarters of the Naval Air Corps, is ready. The land necessary has already been provided for, and the plans of the various buildings required are completed. The Supplementary Naval Estimates admit of the purchase of ten machines, a number that will be sufficient to permit of a definite estimate being made of the services which aviation will be able to render to the navy.—*United Service Gazette.*

A new era has been opened in the matter of directing artillery fire at targets unseen by the gunners from information furnished to them by aerial scouts. Performance of aeroplanes in the Continental maneuvers of 1911. Captain Bellenger in a single-seated monoplane and Captain Casse, Lieutenant Blard and Lieutenant Menard (each accompanied by an observer) in three double-seated biplanes were directed to reconnoiter the scene of operations of an enemy supposed to be advancing on Verdun and to report the effect of artillery fire from their own side. The latter fired live shell, but, of course, only marks or dummies represented the force of the enemy, which were invisible to the gunners owing to the elevation of the ground between them and their objectives. The aviators rose to a height of 4000 feet to comply with supposed conditions of safety, circled around over the enemy during the engagement and by means of dropped messages indicating the results of the firing from time to time rendered the shooting far more effective.

The success of the aerial scouts in the French and German exercises has developed a tendency among enthusiastic advocates of the aeroplane to assume that the army airman will entirely take the place of the cavalry scout, but it is well to point out, says the London writer, that it is unreasonable to suppose that the aeroplane can do more than very considerably lighten the labor of the cavalry reconnoissance and allow the mounted troops more rest and more freedom for purposes of tactical aggression while at the same time reducing the strain on the horses. On September 9, during the French maneuvers, not one of the twenty-four aviators on both sides could go up on account of the weather. Such weather crippling of the activity of air scouts and other dangers and mishaps must be taken account of and the net result is to make it plain that it would be most unwise to rely upon the continuous efficiency of aerial scouting in any form, if unsupported by mounted troops forming a protectice screen against the scouting enterprises of the enemy's cavalry.

The general adoption by the different nations of neutral-colored uniforms is destined to decrease materially the efficacy of the air scout, according to this British student of aeronautics, for whereas hitherto it has been comparatively easy to distinguish friend from foe by the distinctive uniforms with the universal introduction of field service uniforms of grey-green or or mud-color, calculated to make the wearers as little conspicuous as possible, the problem of distinguishing friendly from hostile troops and even of distinguishing scattered troops at all when flying rapidly at a safe elevation will be much more difficult than now. It is hard to say what the aerial patrol will be able to do for his own side in wooded country. He will be visible and possibly audible to the enemy but he will see next to nothing himself. In misty weather he will lose his way and see nothing at all. The ease with which air scouts can be deceived by false dispositions and dummy field works will also tend to vitiate the work of the fliers. In the German Army maneuvers of 1910 the "red" army laid out a dummy position with elaborate

field works which completely fooled the air scouts of the "blue" army, although they were in a dirigible and had a steady platform for observation. —*Army and Navy Journal.*

RADIO.

RADIO IN THE SAHARA.—Signor Marconi announced that no poles or masts are needed in sending radiograms across the desert. Lay the wires along the sand a short distance in the direction in which the message is to be sent, and, due to the complete dryness and non-conductivity of the sand, the apparatus performs its functions as well as before. It is claimed that messages sent in this manner cannot be intercepted.—*Scientific American.*

FRENCH FISHING FLEET.—Following the example set by the German government, a credit of $50,000 has been asked from the French government to encourage the installation of wireless telegraphy in French fishing smacks. Boats carrying their own apparatus will receive an installation bounty of $400 and an upkeep allowance.—*Shipping,* Illustrated.

ENGLAND'S COASTGUARD RADIO OPERATORS.—It is directed that officers and men of the wireless telegraphy section of the coastguard will only embark in the fleet for a cruise of 28 days once in two years, instead of embarking every year as at present. With regard to the signal section, no more embarkations in the fleet are to take place, but the officers and men are to undergo a course of training of 28 to 35 days once every four years in the Signal School at Portsmouth.—*United Service Gazette.*

ENGLISH CHAIN OF STATIONS.—The Marconi Wireless Telegraph Co. has received a dispatch from its headquarters at London advising it of the completion of a contract with the British government for the erection of a chain of wireless stations, to be known as the Imperial Wireless Chain, linking together a number of the colonial possessions of the British Empire. Among the chief stations of the chain are to be those at London; in Egypt, at the northerly entrance of the Red Sea, and at Aden, at the southern extremity of the Red Sea, both on the eastern route to India; at a central point in India; also at Singapore, in the Straits Settlements, on the route to the Far East, and at Pretoria, South Africa. These are to be the nuclei of further stations in this chain, which is designed to extend the service gradually so as to link London with all the British possessions beyond the seas. The British government allows £60,000 for each station, exclusive of sites and buildings, and allows the company 10 per cent of the gross traffic receipts for the duration of the contract, which lasts twenty-eight years.—*Shipping,* Illustrated.

NEW METALLIC MAST.—An extensible metallic mast for use in connection with wireless work is being experimented with in Germany. The apparatus is not telescopic, but involves a new and novel principle.

Four flexible steel strips are wound on drums, so placed with relation to each other that a four-sided hollow column is formed by the strips when fed from the drums. The strips are provided with teeth and recesses in their edges, which engage in each other as the mast is projected. A light portable mast, having a base about three feet square, can be raised to a height of sixty-five feet. When lowered, the apparatus is six feet high and weighs 385 pounds.—*The Navy.*

JAPAN.—In wireless telegraphy the Japanese have completed a large station at Darien by which they are connected with the Asiatic continental chain of wireless stations. The Japanese naval experiments with wireless communication with vessels of the Japanese trans-Pacific fleet have been satisfactory. The Japanese Navy has introduced aviation and among other aeronautical machines they have adopted a hydroplane.—*Marine Rundschau.*

PANAMA EXPOSITION TOWER.—A memorial tower over 1000 feet above sea level will be built in Lincoln Park, San Francisco, in connection with the Panama Exposition. The possibilities of such a tower for wireless work has appealed so strongly to the Secretary of the Navy that he has issued the following statement on the subject:

The Navy Department is taking steps towards erecting a high-power station on the California coast, in connection with its chain of wireless stations across the Pacific and for communication with ships in the eastern Pacific Ocean. Since the range of wireless depends principally upon the height of the aerial wires above the ground, and since the location of this station at San Francisco would be most advantageous to that city, it would seem that the memorial tower should be erected with a view to its use for supporting one end of an aerial of the most powerful wireless station in the world. The Eiffel Tower in Paris, 1000 feet high, has produced wonderful results in long distance wireless work, and the proposed tower would insure even more remarkable results.—*The Navy.*

MISCELLANEOUS.

HOW TO TEST METAL POLISHES FOR EXPLOSIVE PROPERTIES ON BOARD SHIP.—R. E.—The following order was published by our Navy Department some time ago:

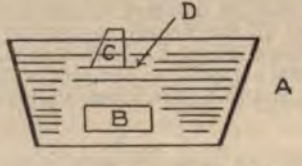
SPECIAL ORDER NO. 1. NAVY DEPARTMENT, Jan. 11, 1912.

As certain brands of metal polish have been found to be explosive, all brands on board ship shall be tested, and those containing explosive gases shall not be allowed or retained on board, unless they are stowed on upper deck.

* * * * * * * * * * * *

While a way to carry this out may, to most of us, be perfectly apparent, still, the following method suggested by Mr. G. W. Patterson, of the Naval Smokeless Powder Factory, may prove useful:

Take a pail or dish pan "A" that is large enough to hold the polish can "B" comfortably and completely under water; a tumbler, tin cup "C" or any suitable-sized collector to be inverted under water; and a plate of glass, wood or metal "D."



Punch one or more holes in the can of polish "B" under water, and preferably warm it in water before the trial. Any gases which may escape collect in cup "C," and the latter with its mouth covered with the plate, carry to a convenient location, and test with a burning match or splinter.

NOTE ON THE HYDRAULIC INTERACTION BETWEEN PASSING VESSELS, CALLED "SUCTION." (See No. 140).—*Titanic* and *New York.*—

April 10, 1912.

Very slowly the *Titanic* left her pier, until she came opposite the *New York,* of the American Line. Suddenly there was a noise like minute guns going off. Seven of the hawsers holding the *New York* to her pier had parted.

The big steamship soon came to a standstill and her three tugs went to the assistance of the *New York,* barely 15 feet separating the two vessels. The tugs got the *New York* back to her pier without a mishap. Then the *Titanic* proceeded down Southampton water on her way.

The *Titanic* is 882 feet 6 inches long, has a beam of 92 feet 6 inches, displaces 66,000 tons and is of 46,000 tons net register.—*Baltimore Sun.*

NOTE ON THE COLLISION BETWEEN H. M. S. "HAWKE" AND R. M. S. "OLYMPIC." (See Nos. 140 and 141.)—The ram of the cruiser *Hawke*, which collided with the *Olympic*, has been found by divers off Cowes. From private advices it appears that the position of the find was 1200 feet from where the *Hawke* was stated at the trial to have been at the time of collision; that is, 1200 feet more to the eastward and a little more to the north of the channel. This would tend to corroborate the evidence given by the officers of the *Olympic* and, furthermore, would tend to show that the *Hawke* had ample room and that the *Olympic* did not make a converging course for the buoy after entering the channel. The appeal from the decision of the Admiralty Court which found against the *Olympic* will be heard in June and it is expected that in view of the fresh evidence just brought to light, a new trial will be ordered and that this time the boot will be on the other foot.—*Shipping*, Illustrated.

THE "KANGAROO."—This is a vessel, built and designed by Schneider & Co., at their Chalon-sur-Saône works, for the purposes of transporting submarines and submersibles over the sea, of docking submarines as in an ordinary dry dock, and, as cargo, to carry all heavy or clumsy material such as turbines, boilers, engines, locomotives. The movable cranes being of great power.

Towing, crossing the Atlantic under their own power, were both impracticable, hence the design of this ship which takes the submarine or submersible into its hold, and thus by analogy receives its name. The vessel has three parts: the forward, shaped as in an ordinary vessel, but fitted with movable entrance in stem making a tunnel through which the boat enters to the large central hold forming the second part. This hold is 193.5 feet long and is really a floating dock where the submarine is shored up on a line of blocks and on appropriate crib work. The third part contains the motor of 850 horse-power, giving 10 knots speed, and the quarters of the crew. Other dimensions are length 305 feet, beam 39 feet, displacement 5450 tons. The first voyage of this vessel will be made soon, and will carry to Peru a large submersible boat.—*Le Yacht.*

TIME TO COMPLETE BUILDING OF BATTLESHIPS.—England: *Vanguard*, by Vickers, two years and twenty-three days. *Hercules*, by Palmers Company, two years and thirty-five days, and the average time to build the fifteen *Dreadnoughts* was two years four and one-half months—all from the order.

Germany: The *Westfalen* and *Nassau* were completed two years and nine months after their laying down; the *Thüringen* in three years and three months from the order. The average of the eight completed German ships was three years and two months.

COST PER TON.—The cost per ton of the latest *Dreadnoughts* is less in Great Britain and the United States than in other countries: the *Orion* costing £83 per ton, and the *Utah*, £87; while the *Thüringen* cost £100; the *Danton*, £122; the *Cavour*, £118.—*The Navy.*

CHRONOLOGICAL STORY OF THE OLD "MAINE."—Aug. 3, 1886, Congress authorized construction.

Oct. 18, 1888, first section of keel laid.

Nov. 18, 1889, launched at Brooklyn Navy Yard, sponsor, Alice T. Wilmerding.

Feb. 15, 1898, sunk by an explosion in Havana Harbor, while peacefully lying at anchor, 275 officers and men killed.

March 29, 1898, Court of Inquiry finds warship destroyed by explosion from outside.

April 21, war with Spain, precipitated by sinking of *Maine*, declared.

October, 1910, work of raising begun.
Feb. 4, 1912, *Maine* afloat inside of cofferdam.
March 16, *Maine* "buried" in 3600 feet of water in the middle of the Gulf Stream, nine miles off the Cuban shore.
March 23, 1912, funeral services and exercises at State, War and Navy Building, Washington, at 2.15 p. m. Interment of remains at the Arlington National Cemetery, same date.

THE BURIAL OF THE "MAINE."—About nine o'clock on the morning of the burial day, March 16, 1912, the battleship *North Carolina* and the scout cruiser *Birmingham* entered the harbor of Havana. An hour later the coffins containing those victims of the disaster that were not recovered until the *Maine* was raised, were borne upon the shoulders of Cuban artillerymen to the battleship *North Carolina*. Sixty-six of the ill-fated crew were found in the wreck, and these have since been buried at the Arlington National Cemetery (on Saturday, March 23).

At 2.15 the signal was given for the start of the funeral procession, and as minute guns boomed from Cabanas Fortress the remains of the old battleship were towed out of the harbor by three tugs, one in the lead and two at either side, to hold it to its course. The American battleships fell in line and were followed by four Cuban gunboats. Dark clouds spread a pall over the sky, and a heavy swell disturbed the sea. At intervals of a mile the *North Carolina* fired signal guns. When about four miles from shore, the American vessels took position to the right of the wreck and the Cuban vessels to the left, while other ships ranged fore and aft to complete the square. A detail of sailors boarded the *Maine* and opened the sea cocks. Very slowly the old hulk began to settle. The marine band played the National anthem. The bulkhead end was first submerged leaving above the water only the stern, from which flew an immense flag. Twenty minutes from the time the sea cocks were opened, the decks gave way under the pressure of the air beneath them. As the setting sun broke through the clouds, the water closed over the *Maine* and its flag. Taps were sounded and then the sirens of the warships wailed a funeral dirge. Thousands of roses that had strewn the deck of the vessel floated on the surface of the sea, marking the grave of the old ship. The *North Carolina* and the *Birmingham* fired a parting salute, and then proceeded on their way home with the bodies of the victims. Thus ended the most impressive funeral ever held at sea.

In the harbor of Havana there still remains the cofferdam with which the wreck was raised. This must be removed, together with the stone that was poured into the mud about the crib work, when all traces of the tragedy will have been wiped away.—*Scientific American.*

THE LOSS OF THE "TITANIC."—The dimensions and general characteristics of this, the largest vessel then afloat, were as follows: 882 feet 9 inches long, 92 feet 6 inches beam, and of 46,000 tons gross register, and displacing from 51,000 tons to 60,000 tons. Length between perpendiculars, 850 feet. She had three screws, each wing propeller being driven by reciprocating engines of 15,000 indicated horse-power, the center propeller being driven by an exhaust turbine of 16,000 shaft horse-power. For going astern the wing propellers only were available.

The S. S. *Titanic*, on her maiden voyage, left Belfast on April 2, Southampton on April 10. On the afternoon of April 14, the S. S. *Amerika* reported to the *Titanic* that she had just passed two huge icebergs in Lat. 41° 27′ N. and Long. 50° 3′ W. That same evening, the *Titanic* was steaming westward at 21 knots, weather clear and bright starlight, when ice was reported ahead. The engines were stopped, reversed, helm put hard astarboard, and bulkhead doors closed from the bridge, when, immediately, at 11.40 p. m., April 14, in Lat. 41° 16′ N. and Long. 50° 14′ W.—or just 13 miles S. 33° W. of where bergs had been reported to her in the afternoon—she struck an iceberg whose submerged ledge tore out all her star-

board bilge. Boats were manned, lowered, and sent clear of the steamer. The *Titanic* sank at 2.20 a. m., on Monday, April 15, 1912. About 8 a. m., the Cunard S. S. *Carpathia*—called by radio from the sinking vessel—arrived on the spot, and picked up and cared well for the occupants of the boats. There were 1652 lives lost and 708 souls saved. Another reliable authority places it at 1635 lost and 705 saved. The cost of this vessel was $8,487,500, and her cargo on this trip was of enormous value.

The lessons to be learned from this accident are:

(1) Steamships must be navigated with more care for safety of passengers and crew, and great risks should not be taken.

(2) Steamships must be built more on navy requirements as to cellular water-tight subdivision of hull.

(3) A more southerly track, clear of ice, should be used.

(4) More boats and other appliances for saving life should be provided.

From an examination of the plans of the *Titanic* we learn, to the great astonishment of every naval officer, that her double bottom did not extend up her sides at all, as is case with *Mauretania* class built to navy requirements, so that the opening of her side left no alternative but that of sinking, and in other words, there were no subdivisions of her hull similar to wing passages of men-of-war, or to auxiliary cruisers. Her compartments were few and all extremely large. The design of the *Great Eastern*, with the double hull extending 10 feet above the water-line, with its 10 transverse bulkheads carried to the highest deck, shows it to have been one of the safest, if not the safest, passenger ships ever constructed. The *Titanic* had but 15 water-tight compartments and these bulkheads were carried only ten feet above water-line, and then not to a water-tight deck. The average length of her compartments was 53 feet. As to boat capacity, much difference of opinion exists. The Board of Trade rules call for a boat capacity equal to fifty per cent of the total number carried. Accidents seldom happen in weather in which boats could be used at all.

BOOK NOTICES.

"Modern Seamanship." By Rear-Admiral Austin M. Knight, U. S. Navy. New York, D. Van Nostrand & Co., 1910, 531 pages, 159 full-page plates. Price $7.50.

This is the fifth edition. The first edition appeared in April, 1901.

In the present edition, about one-half of the material retained from former editions has been re-written, a large part of the remainder revised, and the following chapters added:

Chapter 19—Handling Torpedo Vessels and Submarines.

Chapter 20—Keeping Station and Maneuvering in Squadron.

Chapter 25—Hints for Junior Officers.

The revision of Chapter 12, "The Rules of the Road," is practically new. All of the chapters in previous editions which dealt with sailing vessels have been omitted, except that a brief description of such vessels is included in the Appendix, because the author believes, and wisely, that some mention should be made of this matter, though as part of a naval officer's profession, it is nearly obsolete.

The care and skill with which the book has been prepared, both by the author and the publisher, deserve admiration, unqualified and positive. Both in general plan and in detail, the book leaves nothing to be desired. Every department of seamanship is covered; every appliance and every method is explained in words, and illustrated by plates, with perfect clearness and completeness.

The scope of the work may be indicated by stating the headings of the various chapters, which are as follows:

Chapter 1—The Hull and Fittings of a Ship.
Chapter 2—Rope; Knotting and Splicing.
Chapter 3—Mechanical Appliances on Shipboard.
Chapter 4—Blocks and Tackles.
Chapter 5—Handling Heavy Weights.
Chapter 6—Log and Lead; Submarine Signals.
Chapter 7—Boats.
Chapter 8—Handling Boats in a Surf.
Chapter 9—Ground Tackle.
Chapter 10—Carrying Out Anchors.
Chapter 11—The Steering of Steamers.
Chapter 12—The Rules of the Road.
Chapter 13—Maneuvering to Avoid Collision.
Chapter 14—Piloting.
Chapter 15—Handling a Steamer Alongside a Dock.
Chapter 16—Placing a Ship in Dry Dock.
Chapter 17—Weather and the Laws of Storms.

Chapter 18—Handling Steamers in Heavy Weather.
Chapter 19—Handling of Torpedo Vessels.
Chapter 20—Keeping Station and Maneuvering in Squadron.
Chapter 21—Towing.
Chapter 22—Rescuing the Crew of a Wreck.
Chapter 23—Man Overboard.
Chapter 24—Stranding.
Chapter 25—Hints for Junior Officers doing Line Duty.
Appendix.

The thoroughness with which these various subjects have been treated may be indicated by stating that the book comprises 531 pages, each page 9″ x 6″, besides 159 full-page plates, and that the language is extremely terse.

Perhaps the best chapter in the book is the chapter on The Rules of the Road. It is hard to see how this chapter could be improved. While the rules of the road were doubtless intended to be very simple, it is a matter of fact that they are not simple at all; and it is also a matter of fact that some of the rules are expressed very ambiguously in the law. In Admiral Knight's book, the rules are not only given, but they are commented on with much elaboration, and explained with minute care and clearness. Citations from legal decisions are given, and many cautionary remarks are made, pointing out where the rules have been sometimes misinterpreted, and are liable to be misunderstood. The rules are illustrated with thirty-five excellent diagrams, nineteen of which are partly in color.

It is evident that Admiral Knight has a just appreciation of the importance of a thorough understanding of the rules of the road, which is perhaps the most important single subject in seamanship, and that he spared himself no labor in elucidating them. No officer can read the chapter on The Rules of the Road without receiving benefit.

One of the distinctive features of the book is the elegant clearness and conciseness of the diction. That such beautiful English should be used throughout a purely technical work is perhaps surprising, but certainly it is desirable, because it lightens the labor of understanding, and renders study attractive. This merit appears in its most pleasing form in the chapter on the Laws of Storms, which the author makes not only extremely instructive, but intensely interesting also.

This chapter is so fine that it is to be hoped that Admiral Knight will go into the subject still more deeply. It is a subject that concerns the seaman intimately, and yet most of us realize that there is a hiatus in the theory somewhere. This chapter is commended to the earnest attention of every officer, not only because it is so good in itself, but because its clear exposition of the present theory makes the subject so alluring that it may stimulate some one to take it up as a specialty, gather fresh facts, and formulate some laws which will help us to foretell the weather better than we can now.

All the chapters are good, all the subjects are well handled, all the explanations are clear, all the conclusions are correct. The book is intended primarily for naval officers, especially for the younger officers. It deals

mainly with conditions as they are in the naval service; and yet the principles it enunciates, and the methods it describes, apply to all departments of the seaman's art, and vitally concern those who cruise in the merchant service also. It is a book which every seaman, no matter how well versed he may think himself to be, should consult with the greatest care, and keep always at hand for reference.

BRADLEY A. FISKE, Rear-Admiral, U. S. Navy.

"Interior Ballistics." Third Edition, 1912, by James M. Ingalls, Colonel, United States Army (retired). New York: John Wiley & Sons, 1912, 186 pages. Three tables for use in computations. Price $3.00.

"When, in the summer of 1889," as stated by Colonel Ingalls in the Preface to the edition of 1894 (Second Edition) which forms a first preface in the present book, "it was decided by the staff of the Artillery School to add to the curriculum a course of interior ballistics, the instructor of ballistics, knowing of no text-book on the subject in the English language entirely suited to the needs of the school, employed the time at his disposal before the arrival of the next class of student officers in studying up and arranging a course of instruction upon this subject, so important to the artillery officer. The text-book then planned was partially completed and printed on the Artillery School press, and has been tested by two classes of student officers.

"In the summer of 1893 the author again had leisure to work on the unfinished text-book, but in the meantime he had found so much of it which admitted of improvement that it was decided to rewrite nearly the entire work as well as to complete it according to the original plan by the addition of the last two chapters.

"With the exception of portions of Chapters IV and V, the author claims no originality. He has simply culled from various sources what seemed to him desirable in an elementary text-book, arranged it all systematically from the same point of view and with a uniform notation."—Artillery School, February 15, 1894.

"The Second Edition," as stated in the Preface proper to the present edition of 1912 (Third Edition), "was used as a text-book at the Artillery School until the school suspended operations at the outbreak of war with Spain, in April, 1898. This edition, having become exhausted, the author has been induced by the request of officers for whose wishes he has great respect, to prepare a new edition embodying the results of some investigations which were published in Volumes 24, 25 and 26 of the Journal of the United States Artillery."

The First Edition it seems was never issued, if published.

By the way of introduction, and before proceeding to a more extensive review of this book, it will be worth while to indicate as briefly as possible the method used. This can be fairly well done in a paragraph by referring the reader to a paper published in the PROCEEDINGS OF THE UNITED STATES NAVAL INSTITUTE, Volume XIV, No. 2, 1888, Whole No. 45, under the

caption "Velocities and Pressures in Guns," by Ensign J. H. Glennon, U. S. Navy. If on page 403 of this number, the fifth line, reading,

"Integrating (9), replacing (n—1) by .4 or 2/5,"

is changed to read,

"Integrating (9), replacing (n — 1) by 1/3,"

and the integral as thus changed is tabulated, as it can be much more readily than the unchanged integral, all else except the value of n, which is changed throughout, to remain as it is there, that is, if all the other functions named there are based in exactly the same way on this new integral, which in its general form is the key to the whole matter, and if the velocities and pressures are expressed by exactly the same formulæ, and are used in exactly the same way, the method will be completely and exactly, even if briefly described.

NOTE.—The radical sign prefixed to the denominator of this changed integral as shown in equation (9) page 82, Ingalls' Interior Ballistics, Third Edition, is a typographical error, and should be omitted.

If, in addition, the formulæ are deduced without the aid of the so-called "general equation of motion" in a gun, but directly from the thermodynamic laws of gases, as was done in the Interior Ballistics by Lieutenant J. H. Glennon, U. S. Navy, published in 1894, a method of initial procedure used by Colonel Ingalls in the present Third Edition of 1912 (but not in the Second Edition of 1894) will be covered also.

The key integral above referred to was new in the paper on "Velocities and Pressures in Guns," and does not belong to Sarrau or other previous writers. There is no suggestion in any of their writings as to dropping the solution by series as used in the French and other Continental books, and it involved a distinct heresy from their methods. It would seem that any reference by Colonel Ingalls to this paper on "Velocities and Pressures in Guns" must be looked for in the comprehensive predicate found in his Preface to the Second Edition of 1894, viz.:

"culled from various sources,"

and it is not elsewhere mentioned in the prefaces or subject matter of the Third Edition; nor is its author. It would also appear aside from the personal predilections of the Colonel and his possibly better arrangement of the subject for the use of student officers that any originality of *method* if it can be so called comprehended in the statement in his Preface to the Second Edition, viz.:

"With the exception of portions of Chapters IV and V, the author claims no originality"

consisted in substituting 1 1/3 for 1 2/5 as the ratio of the specific heats of the powder gas. And in this connection, "lest we forget," the following from a continuation of "Velocities and Pressures in Guns," entitled "Powder in Guns" (see page 28, Whole No. 52, U. S. NAVAL INSTITUTE PROCEEDINGS, 1890), is illuminating:

"I do not consider n = 1.4 as final or necessarily the best value; n is greater than 1 and probably not greater than 1.4. Tables could just as readily be calculated for 1.2 or any other value as for 1.4."

The chapters referred to, it may be noted, contained the meat of the whole subject, especially in so far as it was new.

Formulæ of this kind require extensive test. The original tables in "Velocities and Pressures in Guns" were based on theoretical considerations, pure and simple, at a time when this and kindred subjects in ordnance and gunnery were being developed by officers of the army and navy, and many of the elements of the loading of guns were still indefinite or inaccurate. The ratio assumed for the specific heats of the powder gas was that for perfect gases, or 1.4. Many still believe this the best value for that ratio per se in spite of some evidence to the contrary, as this gas is very far removed from the liquid or solid state by its high temperature. The deduction of these formulæ involved as well an assumption that there existed in the products of combustion of the black or brown powders to which they were applicable a non-gaseous residue equal in volume to the total volume of the original powder grains. It was and is well known that this assumption could not be true with any exactness; and in the application of the formulæ, the use of 1 1/3 in place of 1 2/5 has an influence corrective at least in part, for this very inexactness. But the author goes further. He applies these formulæ to smokeless powder, both cordite and nitro-cellulose, where there can be no such non-gaseous residue, and shows in his applications that the formulæ with his tables have about the same relative exactness when used with these smokeless powders that they had when using the original tables (where 1.4 was used as the ratio of the specific heats of the powder gas) with the earlier common powders. This naturally impels one to suggest that a still further adjustment of this ratio to meet the greater inexactness of the volume of the non-gaseous residue (with smokeless powders) would probably have given even better results than are shown in the "Applications." The results are, to be sure, sufficiently astonishing.

The complete method with formulæ and solutions, and working tables sufficient for those who use them only occasionally, but who are familiar with the properties of gases, could be placed on four or five printed pages. The uses, explanations, applications and tests of the formulæ are of course very much more important from a practical point of view, and the present book which gets out of them about everything that can be gotten except Sarrau's own formulæ for black or brown powders (which could readily have been gotten by the use of certain approximations admissible in practice) covers, aside from title page, prefaces, table of contents, tables of functions and a chapter on the rifling of cannon, one hundred and sixty-nine printed pages. The labor involved was of course very great, and, especially if viewed in retrospect, after the fact, very much greater than the labor of production and combination of the ideas embodied in the original formulæ.

We will now go into the subject matter in some detail. After an introductory chapter with definitions and an early history of Interior Ballistics covering many old familiar names, the author breaks ground on his subject proper with a deduction of the thermo-dynamic laws of gases, such as may be conveniently found in Sarrau's researches and elsewhere. He then deduces a velocity formula for any travel of a projectile in a gun when the

weight of powder burned to the corresponding instant is given. It is to be remarked that Sarrau has this same formula,* but as will become obvious by noting the character of his later velocity formula for quick powders (which involves the shape of the powder grain) he either abandons it, or fails to note its full significance. (See equations (21) and (22), pages 89 and 91, U. S. NAVAL INSTITUTE PROCEEDINGS, Whole No. 28.)

After proceeding thus far in a direct line towards his final formulæ, the author digresses for a while to present the other view of the subject as given by Messrs. Noble and Abel. In their method, the gases and non-gaseous residue are assumed to remain at an equilibrium of temperature, as the gases expand in a gun, the expansion being otherwise adiabatic. Sarrau assumes the gas expansion as strictly adiabatic. Noble and Abel do not get into the theory of progressiveness in powder at all, though what is called their factor of effect will correct differences of velocity with different guns and different elements of loading. The author is apparently careful that the methods of Noble and Abel are not confused with his own, for in the twenty or more pages devoted to them in this part of the book, he mentions one or both of them on an average of about once to each page. And though he quotes their experiments and deductions extensively, he is not following their method at all.

He then returns to his subject proper, takes up the progressive combustion of grains of powder, and resorts to a formula involving the fraction of the least dimension burned, a simple device to be sure, but a departure from the usage of Sarrau and others, and a coincidence with that in "Velocities and Pressures in Guns." (See equation, 12th line, page 403, U. S. NAVAL INSTITUTE PROCEEDINGS, Whole No. 45, and equation (22) page 72, Ingalls' Interior Ballistics, Third Edition, noting further use.)

Finally, in spite of the opinions of several later authorities, he adopts Sarrau's law for the velocity of combustion of powder, namely: "The velocity of combustion varies as the square root of the pressure of the surrounding medium." And he is probably right in so far as any single power or root would suit the case. There is room for considerable comment as to this matter, but it would require a chapter in itself. It cannot be treated superficially, and we will not attempt it here. This law, however, leads the author directly to a particular concrete expression by formula for the velocity of combustion of powder under variable pressure. (See equation (2), page 80, Ingalls' Interior Ballistics, Third Edition, and last equation, page 402, "Velocities and Pressures in Guns," U. S. NAVAL INSTITUTE PROCEEDINGS, Whole No. 45.) This formula, simple as it may seem, is also a departure from the previous beaten path.

Sarrau bases his final formulæ on a premise that the volume of the solid (non-gaseous) residue of burning gun powder at the temperature of combustion is equal to the total volume of the powder grains. This is his own; it is based on a careful analysis (of other peoples' experiments), and he had the clearness of perception to seize it for future use, and place it in a working formula for a progressive powder. The same value was taken in

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* Sarrau does not use the special form where 1 1/3 is substituted for n.

"Velocities and Pressures in Guns," and the same is taken here. And not only that: The formulæ as originated were for black and brown powders where the premise was at least approximate; Colonel Ingalls, as previously indicated, shows by his examples that the formulæ are fairly applicable to smokeless powders. And he has gone into their application with a degree of elaboration all his own, a tremendous piece of work, and complete to many of the finest details. He omits, however, to discriminate between the maximum pressure on the breech block and that on the projectile, as well as the maximum *effective* pressure on the projectile, and it is believed that the results would have been even better than they are, if he had done so. As it is, the results with the cordite-using, 100-caliber, 6-inch gun of Captain (now Sir) Andrew Noble are sufficiently impressive, and show the exactness that may be expected with these formulæ and the author's tables, if care and intelligence are used. The results with nitro-cellulose powder are of the same character. The author is to be heartily admired and congratulated on his faith in these formulæ, and his determination to make others see that they are practical. As they stand, they are not foreign, and have never been accepted abroad; or, if so, the fact has never been acknowledged. His voluminous applications literally force them down the adversary's throat, so to speak. It is not probable that short empirical formulæ (possibly due to these) will be abandoned for ordinary occasions of firing at the proving grounds, because of their relative simplicity, but the study of improvement and other questions in the use of powders will have to be made along these very lines. And the author has been brave to submit such a compendium of actual statements with figures to the critics, for if incorrect they can be mercilessly torn to pieces. It is impracticable to follow out all the details of these now. They are presumably correct, and will be left unquestioned here.

It seems an opportune time, however, to notice the following statement on page 159:

"A comparison of these results with those deduced in Problem 1 shows the great superiority of the uniperforated over the multiperforated grain so far as maximum pressure is concerned. The muzzle velocity is the same in the two cases," etc.

This is true as it stands for the grains used, but hardly fair, as the uniperforated grain used has a length of 50 inches while the multiperforated is about one inch in length. It is not true for uniperforated grains of the latter length. Where the multiperforated grain in fact loses out is in its comparatively short length. There are two ends to every cylinder, which in powder constitute additional surfaces of emission and these surfaces cause additional maximum pressure. Proper variations of length enable one to adjust the maximum pressure and initial velocity. But there is a limit to the length of grain imposed by certain other conditions. The first is freedom of movement of the grain in the gun in order to take its proper position in the chamber, so that there will be what might be called equilibrium of explosion. It can readily be understood, let us say with equal spherical powder grains in a closed chamber, that the burning grains, with gas at a high pressure issuing in all directions, are, with their freedom of movement, suspended by their practically equal

repulsions as regards each other, and the neighboring surfaces, in such a way as to be distributed very evenly throughout the chamber. Short multiperforated grains follow very closely the same rule.

But if the grains are long, and arranged fagot form the repulsions between grains are sidewise in direction, the gas from the fagot as a whole escaping at both ends, and the tendency is not so much to separate the grains evenly throughout the chamber as, according as the pressure at either end prevails, to shoot the fagot bodily from one end of the chamber to the other, bringing on a condition there that will shoot it bodily back again shortly and so on.

The pressure may thus be abnormal in places due to the immediate presence of the source of gas; the gas at formation is very much higher in pressure than the average pressure in the chamber can ever be, and though this highest pressure is never manifested on the gun, the stream lines of the flowing gas have in their various parts pressures dependent on their position in the stream. This hampering of the escape of the gas with its increased pressure moreover augments in turn the velocity of emission and it is plain that there can be no equilibrium of explosion, if we may call it so. Under such circumstances dangerous wave pressures may readily be set up. If the inequalities of pressure force the individual grains lengthwise differently, they may get separated out from the fagot and from each other, relieving the situation. But even then from their length they may become snarled in various places, making several violent and unequal centers of explosion which would, however, be better than one center. Or by twisting and writhing around each other, they may break up, thus rendering the pressures uncertain because of the creation of new surfaces of emission. If the powder is all burned at the muzzle, the velocity will be normal, but the gun will have been placed under unnecessarily severe and irregular strains. It is thus well worth while to consider carefully the limiting length of the grain that will admit of free movement.

If now we sacrifice some freedom of movement of the individual grain to get a better theoretical form, we can still have a second form of freedom in a number of centers of emission, as with several short fagots placed end to end which repel each other lengthwise of the bore. This will constitute an equilibrium of a certain type, the resulting waves being much shortened and the burning of the grains fairly uniform.

It should be remarked here that the full value of any abnormal pressure with long fagots will rarely or never be communicated to a crusher gauge in the breech block, being manifested on the sides of the gun in the neighborhood of the fagot and damped by the gas at lesser pressure in the spaces ahead and in rear of it.

The true function then of the holes other than the axial hole in the short multiperforated grain is to supply the deficiency in the grain due to its shortening and the rapid decrease in area of its end surfaces, as it burns. And if we can do this, and equal theoretically the long single perforated grain, we can combine a proper freedom of movement to prevent wave pressures with a curve of pressures suitable to a long hollow projecting beam (such as a gun) which from considerations of vibration and drooping should have a proper taper. A charge of long multiperforated grains

could readily be made which, without any abnormal pressures, would blow off the muzzle of such a gun; and abnormal pressures have blown off the muzzle of at least one navy gun in a case where long single perforated grains were used.

The author makes a statement on page 154 to the effect that there is a sudden drop in pressure when the multiperforated grain goes into slivers, as it does when about 85 per cent burned. There may be something not interpreted correctly here, for it is plain that at the instant of formation of the slivers, their total surface is that of the grain, and though there are continuous elementary decreases in their total surface thereafter there is no sudden drop. In short, there must be an angle or hump in the pressure curve at the corresponding point of travel of the projectile, and the curve must suddenly become very steep comparatively, but there can be no theoretical break in the continuity of the curve.

Sarrau is mentioned by name once or twice in this book in a casual way in connection with some point. He is not mentioned in the history of those who contributed to the subject, and there is nothing whatever to indicate that he pointed the way. Notwithstanding the contributions of Noble and Abel, the author as stated before is not following their methods. But he is following Sarrau's general method (with a certain heresy) and is basing his results on Sarrau's premises. The French writers, and many other Continental writers on this subject, think in integral equations, and Sarrau, it is believed, got diverted too far along this same line. This is avoided here by substituting a letter for a definite key integral when found and then going ahead on that as a basis. And time is eliminated by using certain dimensions which Sarrau omitted to do.

Taken all in all, from a strictly ballistic point of view, this book is as good for practical results as any other book on the subject in circulation at this date, and probably better.

Certainly everything is presented in as simple a manner as it can be presented, the author's notation is excellent, and the fact that the tables have been calculated by him, or under his supervision, carries with it a conviction, in view of his general reputation in other fields and with other ballistics, that they are strictly accurate. There is no objection ballistically to using the ratio 1/3 for the specific heats of the powder gas. Noble and Abel's results in fact indicate 1 1/3 this value approximately for the gases of ordinary gun powder when exploded in a closed vessel. The practical assumption of a co-volume (non-gaseous volume) which does not exist with smokeless powders, and only in part with the ordinary powders moreover necessitates in a working ballistic formula a smaller ratio than the true one, whatever it may be.

The apparent inconsistency of applying these formulæ to smokeless as well as ordinary powders seems to require some explanation and with a view to giving a clear insight into what actually transpires, attention is invited to the following, which involves some repetition of what precedes:

(a) In deducing the original formulæ, the powder gas was assumed a perfect gas with the non-gaseous residue equal in volume to the solid volume of the powder grains and the gas was assumed to expand without

gain or loss of heat. The ratio of the specific heats of the gas was denoted by n, and for these conditions

n equals 1.4.

(b) Now the residue at the instant of its formation is together with the gas at the temperature of combustion of the powder, and as the gas expands with a lowering of its temperature consequent on the work done, it is possible, the hot residue being presumably finely distributed throughout the gas, that this residue imparts to the cooling gas more heat than the gas imparts to the gun. To meet this condition in the formulæ, there being no other compensation, it becomes obvious on a little consideration that

n must be assumed as less than 1.4.

(c) But if on the other hand, the residue or other source of heat does not impart as much heat to the expanding gas as the latter imparts to the gun and we do not otherwise compensate in the formulæ, we are compelled to assume that

n is greater than 1.4.

(d) And if everything remains as stated in (a) except that the volume of the residue is less than the solid volume of the powder, and we attempt to compensate for this error by changing the value of n as involved in the tabular functions of the formulæ, we will have to decrease it, or make

n less than 1.4.

There are other things that might be considered, such as whether the gas is perfect, etc., and it is plain that the subject is not exhausted with these equalities and inequalities, but they suffice for present consideration. Let us note the application of them as they stand. For ordinary powders the question arises at once does (b) or does (c) prevail? On account of the great difference in temperature of gun and gas as well as the loss of heat by friction of the gas on the gun, it is quite likely that of these two (c) has the predominant effect. There is, however, no doubt as to the last or (d) and that (d) more than overcomes the predominating effect of (c) over (b) is indicated by the better results when a value 1 1/3 is substituted for 1.4, as n in the formulæ (assuming of course that a long series of tests at the Artillery School, and elsewhere, has demonstrated this superiority with ordinary powders).

Let us now consider smokeless powders. There is no residue, so it is evident at once that (c) and (d) stand alone and in full value, and have opposite influences. And any doubt as to which influence is the greater is set at rest by the results shown in this book, as well as by a consideration of what these influences are. Though (c) has been treated very casually at times, some late results with explosions, even detonations, in a closed volume indicate that the cooling effect of the envelope should always be considered with the lower densities of loading, and, therefore, though in a lesser degree, with the higher densities of loading. The temperature of the smokeless powder gas is higher than that of the ordinary powder gas, and consequently more heat is presumably lost to the gun; and there is no com-

pensating source of heat. So though the decrease of n due to (d) must be considerable, the great increase due to (c) apparently serves to retain n in the vicinity of 1 1/3 for smokeless powders. Those who are going to develop this subject further, and it is worthy of a good endeavor will therefore do well to study this book very carefully.

It is possible that the author endeavored to keep out certain considerations, of a minor ballistic character, in order that the practical working should not be clouded. Thus, it is certainly simpler when two parameters are to be obtained from two measured quantities, such as the maximum pressure and the muzzle velocity of a gun, to employ these measured quantities as they are without considering that one of them is subject to a certain reduction.

It has then certain limitations to the field of practical ballistics. As a matter of fact, and nothing is more easy of demonstration than this (notwithstanding certain fumbling by late writers), the maximum pressure on the breech block exceeds that on the projectile (not to speak of effective pressures) in present guns by as much as one-tenth or more, and it is probable that if the ratio of specific heats of the gas were taken as 1 1/4 (the tables are easily calculated) the results, so far as the actual velocities and pressure are concerned, would be even more accurate than they are, especially with smokeless powders. The fact that it is necessary to assume a co-volume, which cannot exist in full with any powder, to account for the pressure in a closed vessel, where the assumption is made that Mariotte's law is applicable, does not constitute a reason for such an assumption in other cases where Mariotte's law as such can play no part. In fact, it is very doubtful if Mariotte's law alone should ever be applied strictly in the case of any explosion for the reason that it thus becomes logically necessary to drop consideration of the pressure due to the sensible motion of the explosive products, a pressure comparable with that due to their molecular motion. The pressure in short that is shown by a gauge for an explosion in a closed vessel is probably a function of the form of the powder grain (in a minor degree) and rate of burning in addition to other quantities just as it is in a gun, and one can only hope that Colonel Ingalls or some one else who has the time, ability and energy will take up this subject again in the future and develop it along strictly theoretical lines on some such basis. It is important not only for guns, but for all internal combustion engines. The gun is simply a very perfect engine and should be made to assist in clearing up the apparent vagaries in the present thermo-dynamics of gases. And the principles involved are of more importance generally speaking than the immediate results.

J. H. GLENNON, Captain, U. S. Navy.

LIST OF PRIZE ESSAYS.

1879.

Naval Education. Prize Essay, 1879. By Lieut.-Com. A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880.

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881.

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882.

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut.-Com. F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883.

How may the Sphere of Usefulness of Naval Officers be extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884.

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885.

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886.

What Changes in Organization and Drill are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887.

The Naval Brigade: its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888.

Torpedoes. Prize Essay, 1888. By Lieut.-Com. W. W. Reisinger, U. S. N.

1891.

The Enlistment, Training and Organization of Crews for our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892.

Torpedo-boats: their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894.

The U.S.S. Vesuvius, with Special Reference to her Pneumatic Battery. Prize Essay, 1894. By Lieut.-Com. Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895.

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut.-Com. Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896.

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention, 1896. By Lieutenant John M. Ellicott, U. S. N.

1897.

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

1898.

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut.-Com. Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900.

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901.

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903.

Gunnery in Our Navy. The Causes of its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904.

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905.

American Naval Policy. Prize Essay, 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear-Admiral Stephen B. Luce, U. S. N.

1906.

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut.-Com. A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906. By Pay Inspector J. A. Mudd, U. S. N.

1907.

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A few thoughts on our next step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut.-Comdr. Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908.

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENSE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut.-Commander Yates Stirling, U. S. N.

1909.

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910.

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotten, U. S. N.

1911.

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912.

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut.-Commander T. D. Parker, U. S. N.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1913.

A prize of two hundred dollars, with a gold medal, and a life-membership in the Institute, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1913. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. If, in the opinion of the Board of Control, the best essay presented is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention" or such other distinction as the Board may decide.

5. In case one or more essays receive "Honorable Mention," the writer of the first of them in order of merit will receive seventy-five dollars and a life-membership in the Institute.

6. Any essay not having received honorable mention may be published also, at the discretion of the Board of Control, but only with the consent of the author.

7. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

8. All essays submitted must be either typewritten or copied in a clear and legible hand.

9. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

RALPH EARLE,
Lieut.-Commander, U. S. N., Secretary and Treasurer.

MEDAL PRESENTED TO WINNER
PRIZE ESSAY CONTEST, 1912

NOTICE.

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now enters upon its thirty-ninth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII.

Sec. 1. The Institute shall consist of regular, life, honorary, and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control, and a vote equal to one-half the number of regular and life members, given by proxy or presence, shall be cast, a majority electing.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control, and, if their report be favorable, the Secretary and Treasurer shall make known the result at the next meeting of the Institute, and a vote shall then be taken, a majority of votes cast by members present electing."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

BE READY FOR WAR.*

By BEEKMAN WINTHROP, Assistant Secretary of the Navy.

It is with some hesitation that I agreed this year to deliver the opening address to the War College, as I realized that any discussion of the work of a war college is in large part technical, and can best be discussed by technical experts. On the other hand, it is of advantage to men of any profession at times to have the general scope of their work, as distinguished from the technical details, discussed from an outsider's point of view—from the point of view of a layman. Partly for this reason, but mainly because I desired to express the interest the Navy Department takes in this college, I decided to accept the invitation of your President tendered a few weeks ago. It is most desirable that the work of the War College should be emphasized. Your work is not spectacular, it necessarily does not attract or hold the attention like gun work at battle practice, or the maneuvers of an extensive fleet, or even like the well drilled evolutions of a trained body of Jackies. While improvements in firing, or developments in the design of ships can be easily appreciated even by a mind not trained on technical lines, the necessity for a serious, hard course in the art of war is not so self-evident to the ordinary civilian. To the average layman the desideratum is fully obtained by providing a well disciplined force and the highest development of

*Address delivered at the opening of the U. S. Naval College on June 1, 1912.

material. Such, of course, is not the case. The training of the force and the development of material to their highest point of efficiency is of the utmost importance, but an efficient administrator with high technical knowledge of ordnance, engineering and general naval mechanics, with a thoroughly disciplined and powerful force, might well fail when brought into conflict with a more skilled strategist, even though armed with less numerous or efficient weapons. History is full of such cases. In the battle of Salamis, Themistocles, with only 310 sail, defeated the fleet of the Persian King Xerxes, composed of some 2000 ships. In 1630 Admiral Tromp, of the Dutch Navy, signally defeated a Spanish fleet, under Admiral Oquendo, of more than double the number of vessels. Consider also Nelson's victories of the Nile and Trafalgar, won over superior numbers by more skillful strategy.

Preparedness for war does not end with a sufficient number of adequate ships and a ready supply of well-disciplined men. Just as important as these two branches is the preparedness of the directing officers to meet any strategic situation or emergency. The quality of leadership is all important. It would indeed be a short-sighted and extravagant policy to build expensive fleets unless men were provided fully trained to know how best to use and dispose of them. Initiative, self-reliance, resolution and ability to forestall the enemy's moves are qualities that must be developed to produce an efficient leader.

Just as in every profession practical experience is the best training, so the best training for war is war. In the past such practical training was not infrequent. Before the present high development in the munitions and art of war, when wars were not so serious in their results and did not cause such a terrific financial drain on a country, whether victorious or defeated, they were of more frequent occurrence and of longer duration. Until comparatively recently, indeed, countries were so unprepared for hostilities that the first months, or even years, after war was declared were spent in preparation, assembling supplies, recruiting and training, before decisive actions occurred. Under such circumstances leaders developed and trained during the early stages of the conflict were available long before the termination of hostilities. Such was the case with men like Sheridan, and even Grant, for although the latter fought in the Mexican War, he was practically unknown prior to the capture of Fort Donelson

in 1862. Moreover, in former times officers who had gained experience in one or more prior wars were generally available to apply that experience in the pending hostilities. Conditions have changed. In these days events move rapidly. No longer is there a long delay between the declaration of war and the outbreak of hostilities. The first blow is all important. It may well decide the war, leaving the defeated nation in such a weakened condition that even with great financial resources, it has no time to rehabilitate and prepare itself for another conflict before the final blow is struck. In these days we have not the time to train our leaders by the sanguinary process of actual war, even were we not prohibited by the enormous loss of life and property that such a course would entail. Nor can we count on leaders in the future who have had experience in past wars. In this country since the Revolution an average of twenty-seven years have elapsed between wars of any magnitude in which we have been engaged. Between the Revolution and the war of 1812, twenty-nine years elapsed, then ensued thirty-four years of peace until the Mexican War. Thirteen years later we were engaged in the greatest struggle of our existence, the Civil War; and thirty-three years after its close the Spanish War began.

In the future I believe and trust that wars between leading nations will be of less frequent occurrence, but even taking that average of nearly thirty years, you will see that any officer who held sufficient rank to take a leading part in one war would in all probability have passed the active stage of his life before the next contest began. The responsibilities of present-day wars is so great that only comparatively young or middle-aged men can long endure the physical and mental strains. The average age of Farragut, Porter and Foote in the Civil War was fifty-two years, while the average age of probably the three most distinguished generals on both sides—Grant, Sherman and Sheridan; Lee, Jackson and Johnston—was but forty-four years. At the battle of Tsushima, Togo was fifty-eight and Uriu but forty-five. It will be seen, therefore, that few of these men could have gained practical experience in previous wars, if they occurred only at intervals of thirty years.

It being impracticable, therefore, to rely on actual experience in war to train our officers, what is the best method to pursue and what in general must be the aim of such training? Broadly

speaking, an officer must be well versed in the handling and administration of ships and in the technical details of their equipment. This technical training is supplied at Annapolis and in the post graduate special courses in engineering, ordnance, naval architecture, etc., and the practical application of such training or experience is furnished in the periodic cruises. The necessary administrative training, including the handling and directing of men, is afforded by the every-day duties of an officer from the moment he receives his commission as Ensign.

But the broader knowledge of the art of war—an equally important part of every officer's training—must be derived from other courses. It must come from a careful study of past wars, taking advantage of the experience of others, and a detailed consideration of all probable or possible contingencies in wars to come. Only by a careful preparation on these lines can an officer adequately supplement the technical and administrative training he obtains elsewhere. No line officer is fully qualified for command unless and until he has made such a study, and this War College was established and is maintained to afford suitable opportunity for such study. I fear that at times the importance of the study of the art of war is lost sight of. I know it is so among civilians, and I have occasionally noticed the same tendency among certain officers. Naval officers are measured mainly by their skill in handling ships, or their efficiency in ordnance, machinery or other parts of the fighting machine. This is necessarily so, as the opportunity to so gauge their qualifications comes daily. Owing to the infrequency of wars there is but little opportunity outside this course to test the average officer's ability on the broader lines, as a strategist or a war leader. Gunnery, seamanship, navigation, engineering, etc., are all merely incidents in the full development of a naval officer. Those details must be mastered, but unless the leaders are also skilled in the art of war the labor expended is in large part wasted. An accomplished fleet or army administrator, or an expert in war equipment would not necessarily make a good leader in time of war. The most striking example of this in recent years is, of course, McClellan, an able and efficient organizer but a failure as a battle leader. Grant is reported to have said of McClellan, "The test applied to him would be terrible to any man, being made a major-general at the beginning of the war. McClellan was a young man when

this devolved upon him, and if he did not succeed it was because the conditions of success were so trying. If McClellan had gone into the war as Sherman, Thomas or Meade—had fought his way along and up—I have no reason to suppose that he would not have won as high distinction as any of us." But unfortunately for McClellan he did not have this opportunity, nor was his mind so trained in the art of war, prior to the outbreak of hostilities, to enable him to take proper advantage of his magnificent force.

A well-equipped leader should be prepared beforehand to act upon every conceivable contingency. As Mahan says, "Presence of mind consists largely in preparation of mind." To be suddenly confronted with an unexpected emergency is almost certain to create confusion and irresolution, unless by careful training an ability to meet just such unforeseen contingencies has been developed. The development of this characteristic should be one of the aims of a war college course. Indeed, it is one of the natural results of a study of the art of war. Young officers upon taking the deck are often advised by their superior officers to make up their minds how they would act in various contingencies, for example, should a man fall overboard, should land be sighted or should a squall suddenly arise. This is excellent advice, but how much more important is it for all officers eligible to command to work out similar questions on broad lines of strategy. The consideration and determination of what one should do in various contingencies is certain to strengthen resolution and decision—qualities which are essential in leadership in war. Thus the main purpose of this War College is to consider and determine what should be the course of action in all conceivable situations, preparing officers not only so that they will know how promptly to act should one of such or similar contingencies arise, but developing by such a course of training the essential quanties of leadership. Next to actual war a well planned war college course affords best opportunity for such development thus far devised.

On reading the reports of the Japanese officers during the recent Japanese-Russian War, one cannot fail to be struck by the frequent reference to "Evolutions or movements as prearranged." The reports mention occurrences at the commencement of any action and then conclude, "and thenceforth the movement proceeded as prearranged," showing how carefully every contin-

gency had been considered, every detail outlined. At the beginning of the war the Japanese vessels of all kinds numbered 191, those of the Russians 453. The result was due in large part to this "prearrangement" on the part of the Japanese, and the lack of antecedent preparation on the part of her adversary.

Our Civil War was another glaring example of unpreparedness, in the early days of the conflict, not only in war material but in any well conceived idea of operation. The recently published diary of Gideon Welles is most interesting on this point. Conditions in 1861 were chaotic. No one had any preconceived idea of what should be done. The Secretary of State ordered naval officers to the command of ships and directed their movements in certain cases without the knowledge of the Navy Department. The President himself, at the instance of the Cabinet advisers, would sign or revolve orders to naval officers without informing Secretary Welles and it was only after bitter experience of the folly of such haphazard policy did order prevail. Much of the confusion was due to faulty administration, but in the main it was caused by the failure to prepare any systematic or well digested outline of operation prior to the outbreak of hostilities. No one knew what to do, and movements were suggested, begun and revoked with a frequency that would have been fatal to our cause had we not been faced by an adversary as unprepared as we. If, at the fall of Ft. Sumter, the United States had possessed a strong navy, and an intelligently considered plan of action, the Civil War would have been ended in a few months. It was lack of preparation, both in munitions of war and in any preconceived line of attack, that allowed the war to last for four years.

I realize that these views are probably an old story to most of you, but I desired to emphasize the fact that we in the Department thoroughly appreciate the value of your work. The Department is doing its utmost in the face of most discouraging ignorance and lack of appreciation of the vital necessity of a strong navy to our country, to provide you with adequate tools with which to work. I hope and believe that in the end intelligence will prevail over ignorance, foresight over blind negligence. But, however that may be, it depends and always will depend upon the officers themselves to so prepare themselves to make the best possible use of the tools given them when the necessity arises and the country calls upon them for aid.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE RELATIONS OF THE WAR COLLEGE TO THE NAVY DEPARTMENT.

By CAPTAIN WILLIAM L. RODGERS, U. S. Navy.

In order to see just what part the Naval War College has to play in the organization of the Navy Department, it will be necessary to trace the course of development in the Department's organization since its establishment, and to note how far the Department has been able to respond to the demands upon it in each period of emergency and stress caused by war. While thus engaged, it will be advantageous to turn aside occasionally to note how other nations adapt their organizations to accomplish similar purposes. We shall thus appreciate what was lacking in our navy's early development and why we need a War College.

To begin with, the navy was started by the law of 1794 as a branch of the War Department during the Presidency of General Washington, with General Knox as Secretary of War. The occasion which originated the law was the annoyance caused to American shipping in the Mediterranean by the Barbary pirates; so the navy was begun to attain a definite political objective. As the President and his Secretary of War were both military men of ability, they set about the business of building a navy in the proper way. They assembled several of the ablest members of the Continental Navy in Philadelphia, explained to them the object for which the fleet was needed, and directed them to decide upon the types of ship required for the purpose. After full deliberation upon the military characteristics required by the special situation of the United States, six frigates were laid down in various parts of the country. According to present-day ideas, the form of organization adopted was very much decentralized. The six distinguished officers of the old Continental Navy who were selected to be the nucleus of the new Federal Navy, were made superintendents of the new ship building yards, and together they placed the contracts

for timber and other large supplies through the Treasury. For the rest, the War Department organized each establishment under the superintendent with a navy agent, a constructor, and a clerk of the yard.

The navy agent was the contract officer for the smaller supplies, the purchase officer and paymaster and the employer of labor. His disbursements required the counter signature of the superintendent. The agent received 2½ per cent on his disbursements; and the office existed until 1865, by which time the agents were political appointees, and were more or less corrupt. They were replaced by navy paymasters in that year. The clerk of the yard was the general storekeeper accountable for all material and the bookkeeping of time and wages. The constructor was the ship builder who worked from the plans approved by the Department which had been drawn up by the celebrated ship builder Joshua Humphreys to conform to the military views of the group of officers who were afterwards appointed superintendents. The constructor was responsible for the efficiency of material and workmanship; the superintendent was charged directly with the rigging and equipment of the ship, and was the inspector and controller of the other departments of the establishment. Later on, as the ships approached completion, Congress passed additional laws, one authorizing the recruitment of a naval force, another establishing rates of pay, and another establishing discipline (Articles for the Government of the Navy). Then, in 1798, as these ships began to go into commission, Congress removed the navy from the charge of the War Department and established it as a separate executive department. But the administration of the navy continued to be very decentralized, as it could well afford to be under the circumstances. During the brief quasi war with France in the West Indies and the subsequent Tripolitan War in the Mediterranean, the navy was in its formative period, and its operations were led by very able men. The Secretary directed the commanders-in-chief as to the objects of the war, and entrusted to them the control of administrative details necessary to carry on the operations.

But Jefferson who succeeded to the Presidency just about the time of the Tripolitan War had no sympathy with the navy and believed that its mere existence was a menace to the peace of the country. Upon the successful conclusion of the Tripolitan War he laid up most of the frigates and did much to break up the rational

but somewhat inadequate organization of the Department which had been developed by Presidents Washington and Adams. The policy of Jefferson was devoted to obtaining a flotilla of gun boats for defence. These were really of little use at any time owing to their small size.

When the country was forced into war in 1812 the Navy Department was totally unprepared either with adequate fleets or with plans. Fortunately, the few fine frigates begun by Washington were ready and were commanded by the able officers trained by Preble in the Tripolitan War. But it required the strongest remonstrances from Bainbridge and Stewart to prevent the Secretary from making the navy safe by laying it up out of reach of the enemy. Upon the declaration of war, the squadron at New York, commanded by Commodore Rodgers, escaped wholly from the control of the Department and put to sea against the wishes of the Department, whose timid instructions fortunately arrived too late to detain it in port. As Mahan points out in his history, the cruise of this force covered the arrival in port of a great number of merchantmen returning home.* In addition to this cruise the chief work done by the navy was on the Great Lakes in the campaigns of Chauncey, of Perry and of McDonough. We find here as elsewhere evidence of great decentralization in the organization of the Department. The men in charge in each theater of war were vested with authority to disburse money to obtain a naval force, and the manner of accomplishing their task was in their own hands. They cut the timber, contracted for guns, enlisted the crews, and if they called on the Department for aid in any of these matters they got little satisfaction, for the Department was unequal to its task. The Secretary of the Navy in office at the outbreak of war resigned in a few months; for although well meaning and industrious he was unequal to the task of getting efficient work out of an unorganized office. He was succeeded by General William Jones, a very able man, with military, naval and civil experience to draw upon, yet early in the spring of 1813 he confessed to Congress that "the vital error appears to me to consist in loading the chief of the Department with the cognizance of details, and with the execution of duties which divert his attention from the great and effi-

* Had the squadron stayed in New York, the British would have blockaded it there and caught the returning merchantmen too. As it was the British squadron had to keep together, while it chased at random. The case illustrates a proper use of an inferior force.

cient objects of the establishment; or the inevitable alternative is to submit the execution of those duties to subordinate agents." Congress replied by a request addressed to him to formulate a proper organization, which he did at the end of the year. Jones' report explains the difficulty he had in supervising the work of the Navy Department, both in the civil and military branches, sketches the outline of the English system and points out its deficiencies in the management of military features. The report then goes on to suggest a form of organization suitable for the United States in which a Board of Inspectors shall have control of the business of the Department subject to the Secretary, and the report prepares a schedule of duties for the board and the assignment of distinct duties to each member.

Congress adopted a modification of the Secretary's proposal, in which the principal change was that the board as established was to act as a unit, so the members had no individual duties to manage under the general supervision of the board. Thus the consultative feature of the British Admiralty organization which is so strong a power for co-ordination of the effort of its individual members was omitted by Congress. In the phraseology of this act, Congress adopted Jones' idea that the board was to control both the civil and the military branches of the Department work, namely, "Construction and Employment," but from the reports of the committees of the Senate and House it is quite plain that Congress did not grasp the idea that there should be such a thing as an organization in the Department for the management of the military affairs of the navy. This Thirteenth Congress took the view which has always since prevailed in Congress that a Navy Department can be and is efficient if its civil branches are honestly and economically administered. The board had no sooner taken office than under the act it claimed cognizance of the "Employment of Vessels." That is to say, the board thought its duties were military as well as civil in their nature. But Mr. Madison decided that the military branch of the navy should be under the direct control of the Civilian Secretary, leaving the civil branches of the navy to be directly managed by the board of naval officers under the Secretary's supervision. This absurd inversion remained the rule until 1842.

But as the Secretary and his clerk were devoid of technical knowledge they were obliged to turn for advice at every instant to the only professional men at hand, the members of the board. This

very anomalous position of the members of the board was in time a principal cause of its downfall.

The board did most excellent work in the line committed to it. It introduced a considerable degree of system and economy in the navy yards, and framed much needed regulations for the military branch of the navy, which were beyond its statutory powers, although no doubt proper enough after the Secretary and President authorized them.

All these improvements brought the board enemies. Many captains who had been kings afloat before the establishment of the board found the latter advising and supporting the Secretary in restraining them and consequently there was a strong feeling in the service against the board. The navy agents and other civil employees objected equally to supervision and control. As the period of peace lengthened, the navy as a military arm was overlooked. Administrations and Congresses regarded the navy as a means of distributing political patronage.

The commissioners apparently never forgot that the navy was military in its nature, and consequently their action in their own sphere of "supply" and their advice to the Secretary on his exclusive military duties was sound and directed toward military efficiency. The constructors of the navy were civilians who shared the prevalent views of the public and of Congress, that the navy was able to fulfill its purpose in war provided it preserved a bare existence during peace, and these did not like the interposition of the Board of Navy Commissioners, between the chief constructor at Washington and the work at the navy yards, for the advancement of military ideas.

Furthermore, as the members of the board were the principal naval people near the Secretary and were known to advise him, the board got the discredit, frequently undeserved, of every military act of the Secretary which did not commend itself to the service.

Besides the board did not have a proper organization under it for the control and sub-division of separate branches of its executive work and consequently, as a board, it had difficulty in handling the details of such work.

Thus, both for what it did and for what it could not control, the board lost support and received abuse, and in 1842 the act of 1815 was revoked and the civil duties of the board were distributed among five bureaus.

In the report made in 1839 by the Secretary of the Navy, at the request of Congress, upon the subject of this reorganization, Secretary Paulding laid down that: "The duties of the Secretary of the Navy naturally arrange themselves under two distinct heads. The first comprises those connected with the more general and comprehensive interests of the state. Among these may be classed recommendations for increasing and distributing the force to be commissioned, as the exigencies of the case may seem to require and the direction, employment and discipline of all persons belonging to the navy. Under the other head may be arranged everything connected with the construction, equipment and maintenance of the naval force.

"The former requires no special technical or professional knowledge or experience, as resort may at all times be had to the advice of those who possess the requisite qualifications. They may, therefore, properly be left to his superintendence (meaning the Secretary) and direction. Such is not the case with the second class of duties, the adequate performance of which calls for long professional experience and it is believed can be more completely attained under the ministration of competent naval officers."

The Secretary goes on to say that these duties of his second class hitherto performed by the commissioners are naturally susceptible to division under three separate heads, each under a single officer, and classified them as follows:

1st. Ship building.
2d. Dock yards.
3d. Supply.

These views of Mr. Paulding as to the relations of the civil and naval branches of the Navy Department, and as to the advisability of the Secretary's assuming complete and sole charge of the naval and professional side of the Department work without any technical adviser are really remarkable, and it is even more remarkable that no one in Congress seemed to have protested at their absurdity.

Two years later another Secretary, Mr. Upshur, reported that he was overwhelmed with work, and needed more help and better arrangements to deal with it, but he approved the report of his predecessor, Mr. Paulding.

Commodore Charles Stewart, who was a strong opponent of the commissioners, proposed a division of work of the Department under six bureaus, of which the first should be in charge of the

personnel of the navy and the employment of the fleet. Two other bureaus were the same as Secretary Paulding proposed, while the other three divided among them the duties of Mr. Paulding's third bureau. The Congress agreed with Paulding and Upshur that the military side of the navy needed no technical control, but otherwise it adopted Commodore Stewart's plan. The result of the change was that additional machinery was provided for the civil branches of Department work, but military efficiency and military organization was an idea not so much as perceived in that Congress any more than it had been by Mr. Madison and other Congresses and administrations subsequent to him.

The three commissioners of the navy whose office had been terminated, took charge of the first three bureaus and a civilian was put at the head of provisions and clothing and a surgeon at the head of medicine and surgery.

The Secretary remained in charge of recruiting, discipline and the military employment of the fleet. The Department continued under this general system through the Mexican War, which, however, made little tax upon the capabilities of the Department because Mexico had no naval force of importance. But the outbreak of the Civil War threw an immense burden on the Secretary, who was in sole direct charge of the entire personnel and the conduct of the war.

The Navy Department came through the Civil War triumphantly, and since then it has been the custom to say that the bureau system of naval administration stood the test of the Civil War, and therefore is adequate to the needs of the navy to-day. The premise is incomplete and the conclusion is an incorrect one. The bureau system did stand the test of the war, but it did not stand the burden of administration by itself. As soon as the war broke out the Secretary developed a great administrative superstructure which supplemented the work of the bureaus.

In the first place a board of officers was formed, which corresponded more or less to the present office of intelligence in combination with a strategy board, to plan the operations of the Department. The work of this so-called Committee of Conference determined in a very great degree the direction of the efforts of the Department for the whole war.

Another board, composed of old officers, sitting in a hotel in New York, was known as the "La Farge House Board." Very

little trace of it is found in the archives of the Department, but it seems to have been a permanent court of inquiry whose duties were to report on the conduct and capabilities of officers of high rank and to advise the Secretary as to appointments and punishments. It did not deal with minor cases or junior officers.

The supervision and co-ordination of the work of the Constructive Bureaus was given to the chief clerk of the Department.

When an Assistant Secretary was authorized an ex-naval officer was appointed to the position and his knowledge of naval operations enabled him to take charge of the conduct of the war and the operations of the fleet. That is to say, under the pressure of a great war the Secretary was obliged to organize his hitherto neglected powers for the conduct of military operations by assigning them to his Assistant Secretary who had professional knowledge. Besides, the work of the Secretary's office relating to the appointments of officers was turned over to an office of detail, and some of the bureaus were subdivided to decrease the labors of their chiefs. There remained to the Secretary as his special field (see Gideon Welles' Diary) the relations of the Department with the President and the public. The Secretary retained in his own hands the Department's dealings with Congress, the control of patronage at the navy yards and elsewhere, and the general policy of the administration as determined by the President and Cabinet.

But this development was not the work of an instant. At the outbreak of war all was in confusion, the Secretary, and even the best of the officers of the navy, had no proper idea of their respective relations with each other and to the Department, and it took some time to find out how the machinery of administration should be managed. Even in the late fall of 1861 the Secretary remarked that "the Department's views as to the attack on New Orleans were speculative and uncertain." But we see that in the end, under the stress of war, the Secretary had developed a system not unlike what we have to-day; the Assistant Secretary was the aide for operations, but with executive authority; the "La Farge House Board" corresponded to the aide for personnel, the chief clerk was the aide for materiel and the Committee of Conference was the General Board. The belief of so many civilian secretaries that the employment of the fleet and the management of the personnel called for no naval training was shown to be totally unfounded by the test of a great war. It was actually managed by an

ex-naval officer. But upon the conclusion of the Civil War all the superstructure erected upon the bureau system by executive authority crumbled. Only the bureaus, with some addition to their number, remained as the permanent work of the legislature. Even the office of Assistant Secretary created to control the military operations of the fleet was abolished by Congress. As there was no war it seemed to Congress that there was no need to maintain an organization ready for war.

The impression which remained with the public, however, and even to a great extent in the navy itself, was that the bureau administrative system, alone and unaided, had proved itself equal to the demands of a great war, and this monstrously mistaken idea has been largely instrumental in preventing any proper organization of the Department since then.

The Navy Department ran along under the bureau system, through twenty years of graft and inefficiency until public opinion authorized Congress to build an efficient fleet.

While the thought of most officers at this time was given to mechanical and administrative developments, the foresight of Rear-Admiral Luce was the means whereby the War College was established with the object of providing for things of the spirit rather than of the body.

A short time previously the office of Naval Intelligence had been founded. At the first, the organization of this office was arranged to follow the bureau work, but it soon appeared that the administrative and mechanical work of the Department was not the only side to its activities, and about the time the War College was started the office of intelligence changed its system of classification of work in recognition of the wider field with which it felt itself obliged to deal. Since that time, the War College and the office of intelligence have worked in support of each other, the one getting information from abroad as to the practice of foreign nations in regard to organization, mobilization, tactics and strategy, while the other institution utilizes the information, thus provided, in plans and studies for the guidance of our own forces.

When the war with Spain broke out, in 1898, the only plan for the war which the administration had was one worked out at this War College in the summer of 1895, and as it was the only one, at all carefully digested, it was perforce the one which both the army and navy followed. It is worth while to examine the broad features

of this plan as it has much which can be imitated with advantage now in similar work.

The essential point to be noticed is that it was a plan for the Department's guidance, in preparation for the campaign, rather than one for the commander-in-chief in his conduct of the campaign.

The conception that the plan is to direct the Department is at the foundation of any sound Departmental war plan or war portfolio.

All through our service in the navy we advance from subordinate duties to higher ones, with the consequence that we are more familiar with the work of our assistants which we have just ceased to perform than we are with our actual new duties which we are just learning. The result is a great and unfortunate tendency to meddle with details which are getting on well without our help, instead of devoting our attention to the broader questions of policy, direction and discipline which properly belong to us.

This error was avoided to a very considerable extent in the war plan formulated at this College in 1895 in expectation of the war with Spain. But upon the outbreak of the war it was necessary to pass from preparation to action, and the Department had the bureaus only for administrative work, but no organization for the strategic control of its forces. Accordingly, the so-called Strategy Board was extemporized to study the strategic situation and offer sound military advice upon current affairs to the Secretary and the President as commander-in-chief. But the government was totally unprepared for war, and so, the new Strategy Board being the only organized body ready to assume the duties of a general staff, it became the reliance of the government in matters strictly beyond the field of the navy just as had happened at the outbreak of war when the Naval War College plan was accepted by the administration because it met no competing plan.

When Shafter's army set out for Santiago the orders to its commander-in-chief were drafted, so it is said, by the Naval Strategy Board. This new body was the only organization either in the War or Navy Department that was unembarrassed by pressing administrative details. It being ready and willing, the President turned to it because nobody else was free to answer his demands. That Shafter did not follow his instructions is a matter which calls for no notice here.

After the Spanish War, the Strategy Board, a temporary organization, lapsed, and the Department once more refused to admit that it had duties other than administrative. But this attitude did not last long. The General Board was soon organized for the purpose of dealing with the military duties of the Department. Owing to the prestige it owed to its president, the admiral of the navy, this board has been able to hold its own and even to improve its early position as the military branch of the Department in spite of the jealousies and fears of the administrative bureaus.

But progress in the Department's organization for securing military efficiency in war continued, and under the present administration the military duties of the Secretary, as distinct from his civil duties, have been more fully organized than at any time since the foundation of the Navy Department.

The work of the Navy Department naturally falls under five general headings, which may be described as Civil Service, Naval Materiel, Naval Personnel, Inspections, all of which are administrative services and lead up to and support the military branch of "Operations of the Fleet." These natural divisions have been recognized in the recent changes in the organization of the Department.

It will be interesting to glance aside for an instant at the organization of the German Admiralty. Although it is impossible for this country with its institutions to follow the system of a military monarchy, yet the efficiency of the German Navy is so high that we cannot fail to profit by comparing its system with our own.

In the organization of the German Navy there are three grand divisions each of which is directly subordinate to the Emperor as commander-in-chief. The first branch is the Imperial Naval Office corresponding roughly to the American bureau system. The Imperial Naval Office supplies raw material for the navy, including recruits, new ships, war material and supplies of all sorts. The second branch is the Imperial Naval Cabinet, corresponding roughly, but not fully, to the office in our Navy Department under the aide for operations, known as "Operations of the Fleet." The Naval Cabinet supervises the fleet in commission and other naval organizations, and turns the raw material supplied by the naval office into efficient ships and fleets.

Every man and ship in the German Navy belongs to one of six great commands at the head of each of which is an admiral who is in direct communication with and responsible to the Emperor

through the Naval Cabinet for the efficiency of his command. This efficiency is developed chiefly through the powers of appointment, promotion and retirement exercised by the Emperor through the Naval Cabinet upon the recommendation of the commanders-in-chief. The tenure of the commanders-in-chief themselves depends upon the appearance and proficiency of their commands at the Imperial Naval Maneuvers every autumn.

Thus the efficiency of the German Navy depends upon decentralization and discipline exercised through the power of appointment and removal rather than upon centralization and narrow rules required by our system where disciplinary removals for lack of efficiency are comparatively unknown.

The third branch is the Imperial Admiral Staff, whose chief corresponds in part to our aide for operations. The duty of the Admiral Staff is to utilize the military forces supplied and trained by the other two branches. It deals with the duties performed by our Office of Intelligence, War College and General Board.

I have brought forward the German organization for comparison with our own because the former is more logical and precise; but our attempt is to provide for the performance of the same duties as those of the German General Staff.

In the development of the American Navy during the last thirty years the attention of the service has been centered on mechanical and administrative development, and we have neglected the corresponding development of the study of the preparation for war.

But it is now high time to accept the material development of our navy as equal to that of others, and, contenting ourselves with sufficient effort to maintain the situation in this respect, we must turn to the study of operations of war and strategic preparations therefor as the most pressing need of the day.

Broadly, of the three organizations which, under the aide for operations, do the strategic work of the navy, the first, the Office of Intelligence, acquires information in regard to probable enemies.

In the past, owing to the general exaltation of matters appertaining to material, the Office of Intelligence has devoted the greatest part of its efforts to gleaning secrets relating to ships, armament, organization, and such details, whereas we should now recognize that its chief concern in the future should be to get such information as will be serviceable in preparation for and during war. We want the Office of Intelligence to provide us reliable news during

the war of all that pertains to the enemy's plans and movements; we want a secure and secret means of communication through neutral countries. We need plans of fortified ports, and particulars as to the enemy's plans for mobilization, and in general what he can do at the outbreak of war and how much time he will need to make his preparations.

The duty of the General Board in preparing the navy for war is, first, to ascertain what demands the national world policy is likely to make of the navy, and to lay down the numbers and the types of ships necessary to accomplish the navy's mission. In the second place, the General Board makes out the necessary plans for war. It is necessary to have a clear idea as to what such plans are.

The plans for war are of two classes, strategic and administrative. The administrative plans embrace those necessary for feeding the war in various theaters. They include arrangements for recruiting, purchase of ships, fuel, ammunition, etc., as well as for repairs, for handling sick and wounded, supplies of provisions and clothing. It is the business of the bureaus to furnish all that is necessary. It is the business of the General Board to consider what will be necessary. The board draws up the requisition, the bureaus execute it.

When we pass to strategic plans they rest on the relative forces of the enemy and of ourselves; on the relative times at which these forces can be brought into action, and the certainty and continuity of their supplies. The basis of our strategic plans will therefore by necessity be careful studies of the relative strengths and times in which the enemy and ourselves can appear in various theaters of war. In technical language the foundation of our strategic plans are the mobilization studies made for both sides. When these are once thoroughly made they are semi-permanent, for the changes in national strength and sea communications are of slow development.

The data for the mobilization studies of the enemy will be furnished by the Office of Naval Intelligence; those for our own forces by the bureaus of the Department. All the data will be worked up by the plan making branch of the navy, namely, the General Board.

When the first tentative strategic plans for a given theater based on these mobilization studies are drawn up, it will no doubt become apparent that certain improvements in mobilization will greatly improve our strategic situation. It will then be the duty of the General Board to point this out to the Secretary, who will

doubtless give administrative orders to the bureaus to do all they can in the direction suggested; and he will further ask Congress for necessary assistance. But in all this plan making it is to be noted that the General Board is making plans for directing and guiding the administrative work of the Department in preparation for and during war. It is not to do the work of the bureaus; it is merely to examine and report what they will have to do to wage successful war.

Before war becomes imminent the General Board, as the plan-making branch of the navy, should have very little to do with formulating strategic plans for the commanders-in-chief. Indeed, it cannot do so with a degree of certainty; the strategic conditions cannot be foreseen far ahead. The forecasts of the enemy's mobilization will not be correctly made, nor will those for our own forces; and all must be modified more or less during the period of strained relations so that a war portfolio drawn up in a period of untroubled peace should not attempt to formulate any detailed plans as to the control of the commanders-in-chief. Nevertheless it is very desirable that several variations of strategic plans should be worked out to meet whatever conditions seem most likely. When war approaches, one of these tentative plans will be selected and modified as necessary to accord with the most recent data as such is received. But in any case, the Department should avoid hampering the commander-in-chief by too much detailed instruction. The Department should indicate its objective; the method of attaining it should be left to the commander-in-chief.

All the preceding remarks regarding the history and present organization of the Department have brought us to the War College and its position in the general system.

We have seen that in the past the views of the Department on the conduct of war have been (again quoting Secretary Welles' words) "speculative and vague." This uncertainty as to what is best to do has been reflected all along the hierarchy of the navy. No two people have had similar ideas as to dealing with a given military situation, even a minor one.

When the commander-in-chief has given a tactical order, he has accompanied it with a flood of explanatory comment; instead of an order it has been unfortunately a lesson.

But when we wage war there must be prompt team work. Every man occupying a position of detached command must understand

the principles which govern his coadjutors. If this is not the case there will be confusion and disaster.

We see this well exemplified in the season's work of a foot-ball team.

The team learns to play before it goes to its great match. Up to that time, the coach makes a lesson of every movement and each error occasions a repetition. One team may have one style of game and another team may have another style; but, for better or for worse, every one in a given team knows how he is expected to play his own part and assist the others. Similarly, for war, we must train all the navy to understand and carry out some one method of making battle and war. If before war we have not agreed upon the general method of conducting it we shall have tactical anarchy. The commander-in-chief will not be able to carry out his ideas without accompanying every order by an explanatory lesson. The days will not be long enough for him to conduct his school and when the enemy appears the battle will show his scholars unable to pass their examination.

It is the object of the War College to do as much strategic and tactical thinking for the navy as possible before the outbreak of war; as a result of its studies, it teaches a doctrine of war which embodies sound professional practice. In this way through its teaching and training the College unifies the professional thought of the service in regard to strategic and tactical matters, by turning out each year a number of officers who take the same views of tactical matters. As a consequence, they will act in harmony when war comes. The method followed in instruction is to deal with concrete problems of war, until the people solving the problems do so readily. In this applicatory system the mental processes followed in considering and solving each situation are identical with those of real war.

When we have worked out many of these problems with thought and patience, solution of new ones becomes easier; and, when war comes, although responsibilities are greater, we do not find ourselves utterly unfamiliar with the ideas then before us. The case is like that of sub-caliber practice, where the dotter practice makes us familiar with the mental processes of shooting before the great guns are actually fired. But side by side with this development of doctrine for the co-ordination of effort the exercise of problem solving has the effect of building up and strengthening of indi-

vidual character to bear the responsibilities of war. Without practice, the ablest officer cannot show the high qualities necessary to command. He cannot readily get this practice except in war, but in the desk exercises of problem solving he has a tolerable substitute. A man bearing the responsibility of a campaign is naturally somewhat overcome thereby and is consequently inclined to be shrinking and timid. But a course in problem solving increases his boldness and self-reliance in meeting the conditions of war and he dares to act because he has learned to have confidence in himself and so he accomplishes something towards developing and increasing that " resolution " which is the soul of great commanders. In war, as Bonaparte said, the moral factors compared to the physical ones are as three to one, and an additional beneficial result of problem solving will be found in the development of confidence and morale in the men of the command as a reflection of that acquired by the commander through school-room exercises in tactics and strategy.

To recapitulate, the Navy Department from the very first has had an administrative side which has worked up the raw material of men and ships into a homogeneous trained and disciplined fleet, but it has always suffered in past wars because it had never been organized to conduct them, and the navy in peace time has never given much thought to preparation for hostilities.

Recently, the Department has organized itself by establishing a military branch for the conduct of war. This College forms a section of this military branch whose duty is two-fold, namely, to develop the capacity of individual officers to conduct war-like operations, and further to develop a uniform doctrine of making war throughout the navy so that we may all feel confidence in each other's capacity, and know what our comrades are likely to do in given situations, and so enable us to act promptly and boldly because we know that there will be good team work in support of each other.

The Naval Academy trains very young men for their administrative and technical duties as officers in time of peace. The course of study there fits officers to make and maintain their commands efficient both in peace and war. The War College is for older and experienced officers to train them and develop their moral characters to assume the responsibility of war and directing its operations.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

DISCIPLINE IN THE NAVY.

By CAPTAIN MARBURY JOHNSTON, U. S. Navy.

The subject of discipline in the navy has been discussed so often in the NAVAL INSTITUTE PROCEEDINGS by officers high in rank, and reputation, that I feel a natural diffidence in placing my views before the service. Still, I feel that I have a message for the service at large, and that it is my duty to speak out in meeting, though my ideas are diametrically opposed to those of a great many officers who have discussed this subject.

Up to the time of the Spanish War the character of the enlisted force of the navy was practically the same that it had been for fifty years; most of the men were picked up in the sea ports, and our apprentice system turned out five or six hundred boys a year from the training station at Newport. These apprentices, after a year at Newport and six months cruise on a training ship, were sent out to serve on cruising vessels. Young and impressionable they found (or thought they did) that it was the proper thing to get drunk and break their liberty. Most of them followed the example set by the older sailors, and of the few who did not, many became warrant officers, and some have commissions to-day.

With the Spanish War came a great change—Congress appropriated money for battleships, and more battleships, and still more battleships. The enlisted force grew by leaps and bounds. It became necessary to leave the sea coast and go inland with recruiting parties to get the men necessary to man the ships. In a very few years the entire character of the enlisted force of the navy changed. The young man predominated. When the U. S. S. *Washington* was placed in commission the average age of her enlisted force of eight hundred and fifty men, was a trifle under twenty years. One Sunday afternoon in 1906 I visited the Metropolitan Museum of Art in Central Park, New York; the fleet was in North River and I saw scattered through the

different rooms at least one hundred sailors in uniform. Clean, clear cut, picturesquely dressed, they wandered through the rooms studying the catalogues which nearly every one of them had bought; absolutely unconscious of the attention they attracted and of the fact that they were doing something that sailors were not expected to do. I went away with a feeling that if the navy could be made up entirely of such men, what a navy we would have! I am of the opinion that we can have a navy composed entirely of just such men; this article is written to show how that end can be accomplished.

It is unfortunately true that a great many men who are natural leaders, and have forceful characters, are morally bad. They exert a bad influence on boys and men who have less strength of character; they are at the root of nine-tenths of the liberty breaking and other serious infractions of discipline, and they should be kicked out of the service at the earliest possible opportunity. Too much stress is laid upon the possibility of reforming these bad ones. The navy is not an eleemosynary institution—it is a fierce business proposition, and to get results we must use business methods. No business corporation or factory would temporize for a minute with employees who have failed to show up at the proper time for work—why should the navy?

Twenty-five years ago men of the navy were enlisted for special service in the Coast Survey and Fish Commission; the commanding officers of those vessels could discharge a man whenever they saw fit; if a man misbehaved, he was paid off, given his bag and hammock, and put on the beach at once. This resulted in better discipline and more contented and happy crews than I have ever seen on a man-of-war. The captain rarely had to use his power because the men knew exactly what they would get for any serious misconduct.

In January, 1889, I succeeded temporarily to the position of executive officer of the Fish Commission Steamer *Albatross,* and performed the duties for one year. We had no brig and the police force on board consisted of one master-at-arms. When men got drunk and disorderly we had to put them in double irons and chain them to stanchions on the berth deck. Shortly after I became executive there was an outbreak—the men got possession of some of the alcohol in the laboratory and so many of them got drunk and disorderly that the stanchions gave out. I had served in the

coast survey eighteen months just previous to joining the *Albatross* and remembering how such cases were handled in that branch of the service, I suggested to the captain (the late Captain Z. L. Tanner) that we try the coast survey method. He demurred at first, saying we could not keep a crew, but I was so positive he finally gave in and gave me permission to try it. The next Sunday at muster the men were informed of the captain's decision that any one who broke his liberty for more than six hours, or got drunk, or committed any serious offense, would be discharged at once as undesirable.

The following (Monday) morning I found that Hansen, chief quartermaster, was absent over time. Hansen had charge of all the sounding machines and was the expert splicer of sounding wire. He was the kind of man who gets to be regarded as indispensable. When his six hours were up his discharge was made out, and when he returned twenty-four hours over time he was the most astonished man on the Pacific Coast when he was given fifteen minutes to pack up and get over the side. That ended all misconduct on the *Albatross*. During the rest of my stay on the ship we never had to discharge another man for that reason. On a coast survey vessel, whose crew consisted of twenty-five or thirty men, the discharge of a single man made as big a hole in the crew as the discharge of thirty or forty men would on a modern battleship.

Something has been done in the service in the way of changes in laws and regulations to meet the new conditions existing since the Spanish War. Congress has passed laws doing away with "irons, single or double," and establishing deck courts. The regulations have been changed so that a man gets his month's pay no matter what his conduct has been, and liberty and leave have been given, whenever the circumstances permit, with a generosity that shuts out all criticism.

The act of Congress doing away with irons was a most excellent one. Few captains ever used irons as a method of punishment, but the articles of war required that a summary court-martial, in giving a sentence of confinement on bread and water, should include irons, single or double, so it was necessary that the law should be changed. The doing away with irons was a great advance in ameliorating the condition of the enlisted man (in hard luck).

The establishment of the deck court was a distinct step backward; in the first place it is a temptation to too many captains to shirk their duty and turn it over to the deck court officer; in the second place its sole function, in practice, is to fine an offender and take away his pay. This is the most fertile cause of dissatisfaction in the navy. When a man enlists, he signs articles in which the government agrees to pay him a certain sum per month, or the pay of the rating to which he might be promoted, the man agreeing to serve a certain length of time and to obey orders and regulations. I do not question the legal right of the government to break its contract, after the man has broken his, I only question the expediency of it, and suggest that when the man fails to carry out his part of the contract, the proper remedy for the government is to abrogate the contract.

I know the old argument that if you discharge a man for misconduct, those that want to get out will misconduct themselves for the purpose of getting their discharge. Very well, I say, give them their discharges (bad conduct or undesirable) and let them go, they are no use on board ship if they are dissatisfied, and they work on weaker natures and make them dissatisfied too.

My idea is to discharge every man for his first serious offense. If he is a good man and offers a plausible excuse for his offense and it is thought that a warning may save him, give him one more chance. But don't give him a deck court or summary court-martial and fine him. If you do that he will feel that he has expiated his offense and is entitled to the privilege of repeating it. Simply warn him and discharge him immediately should he offend a second time. Just as soon as the men of the service find out that all liberty breaking and serious infractions of discipline will be punished by immediate discharge as undesirable, just so soon will it be stopped.

Since the Navy Department has authorized the discharge as undesirable of one per cent of the crew each quarter, I have made it a practice to ask men at the mast whost records were bad, if they wished to be discharged—in seven months I have had only one affirmative reply.

In signing up the enlistment records in January last, for the preceding quarter, I was struck by the very large number of court-martials on some of the records—two men had six each (they also had twenty-six and twenty-eight years continuous service, respectively), one man had five, several had four, and about forty had

three. I had these men mustered on the quarter deck and told them that they had reached their elastic limit—that if they offended again I would do my best to see that they got bad conduct discharges; only two men out of that lot have since committed themselves and been discharged.

The navy at present presents a career for any young man, the men are well paid, well fed, and well amused; most of them are well satisfied. They do not wish to leave the service with a bad conduct or undesirable discharge. They recognize that an honorable discharge is a valuable asset. It means four months pay if they re-enlist, it means preference in obtaining employment at a navy yard, and it has great weight in securing a position in the fire department or police force of the large cities. It is also something that a man can show with pride when he returns to his home. The class of men we get in the navy now-a-days recognize these facts. All that is needed to make the discipline of the navy what it should be is to start the steam roller and threshing machine, crush out the bad ones and winnow out the worthless ones.

Let us assume that the Navy Department agreed with my ideas, and issued the necessary orders to carry them out—what would be the immediate result?

1. The military offense of desertion from the navy would cease to exist. A man on a spree finally dies or he gets sober. If he dies, that ends it. When he gets sober he will give himself up and take his undesirable or bad conduct discharge and save his citizenship. If he does not do so, and is apprehended and delivered up to the naval authorities, he should not be punished for desertion, but sent to St. Elizabeth's or some institution for the feeble minded. Fraudulent enlistment is a thing of the past. The finger print method of identification and the printed slips attached to bad conduct and undesirable discharges, warning men that they are sure to be identified and punished for fraudulent enlistment has made this offense very rare.

2. Our military prisons at Portsmouth, N. H., Boston, Mass., Port Royal, S. C., Mare Island, Cal., and Puget Sound, Wash., would have to be closed as we would have nobody to confine in them. Men convicted of criminal offenses should be sent to state penitentiaries or to United States' prisons.

3. The officers and men on duty at the above institutions would be available for other duty.

4. The deck court officer and the members of the permanent summary court which exists on every ship in the navy of any size, would find more time to devote to their regular duties.

5. General courts would only be required when crimes are committed.

6. The military part of the office of judge advocate-general would have so little work that three-fourths of the officers now on duty there could be detached and sent to other work.

I have named the above because they are obvious, and because the first objection to my plan will be its cost. The real value of my scheme lies in the increased happiness in the navy and the resultant increased efficiency. An over night liberty party of four hundred men leaving a battleship at a navy yard loses from five to eight per cent of their liberty time because the officer of the deck has to line them up, inspect them, and check them over the side. If we only had men we could trust, a man ready to go on liberty could turn his name down on a board in his part of the ship, report to the officer of the deck and walk ashore. This is only one of numerous instances in which the disciplinary rules of the ship, now necessary, might be relaxed for the comfort and happiness of the crew—if the crew were all good.

The very large annual saving made by doing away with prisons would more than offset the cost of the extra recruiting parties that would have to be placed in the field at first. I say "at first" because I am firmly convinced that, in a very short time, there would be fewer discharges for misconduct than we have at present. After getting rid of the bad ones, the discontented ones, and the worthless ones, the people who take their places will have no bad examples to lead them astray, and the only people to be discharged would be the small percentage of mistakes made by recruiting officers.

There is one small fly in the ointment, and yet I'm not sure whether it's a fly or merely another ingredient which will add to the curative powers of the ointment. I mean the extra work that will be put upon the Navy Department in handling the requests of Senators and Congressmen to reinstate their constituents in the navy. If the Secretary should decide on a policy of granting these requests, we might have to discharge a number of men more than once, but a great many reinstated men would feel that they owed their Congressman something, and they would become available men. Then, too, the Congressmen would feel friendly toward the navy if his requests were granted.

The navy is very conservative; it is natural that it should be so. When any change is proposed, the opinion is asked of officers of rank, age and experience. Age and experience are always conservative.

One hundred years ago the European navies recruited their crews by means of the press gang. Samuel Johnson is credited with saying that no man went to sea who had ingenuity enough to get sent to jail, as in jail he would have just as good company, and more safety. But times have changed. Men are no longer fed on salt horse and weevily biscuit. They are not kept on board ship for months and years at a time without being allowed to go on shore. Their wants, comforts, and amusements are carefully looked out for. But in some things we are still back in the days of the press gang. We fall down and worship this fetish of the sanctity of the enlistment contract. We make it hard for a man to get out of the service. Even if a man wants to buy his discharge, we require all kinds of affidavits, and an amount of time is frequently consumed which works a real hardship on the families of deserving men. If we made it easy by getting rid of those who misbehaved, we would soon be in a position to turn around and raise the physical and educational qualifications of the new men we enlisted. I don't think that I exaggerate when I say that nintey per cent of the men in the navy want to stay in it, and finish their present enlistment at least. With the bad ones gone, the re-enlistments would double and treble.

A famous Secretary of the Treasury said "The way to resume specie payments is to resume." The way to get rid of liberty breaking is to get rid of the liberty breakers.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVY YARD PROBLEMS.

By Assistant Naval Constructor J. E. Otterson, U. S. Navy.

Motto: Consider the Consequences.

Alterations to Naval Vessels.

In undertaking alterations to naval vessels we are governed by three considerations: (1) necessity; (2) practicability; (3) cost.

The necessity is determined by the reasons which suggest the alterations. These reasons may be classified as follows: (1) military; (2) mechanical; (3) structural; (4) economical; (5) sanitary; (6) convenience and comfort.

The practicability of an alteration is determined by the ease with which the mechanical and structural difficulties can be overcome and the interferences removed.

The cost of an alteration is dependent to a large degree upon the practicability and is justifiable only if there is sufficient gain in military value, in mechanical or structural perfection, in economical operation or maintenance, in sanitation, convenience or comfort.

The burden of proof of the necessity for an alteration rests primarily with the official suggesting it. In general, alterations subsequent to the final commissioning of a ship are made necessary only by a change in conditions.

The demonstration of the practicability of an alteration rests to a certain degree with the official suggesting it, but since, as a rule, he has not at hand the expert knowledge or means with which to work out plans or make calculations, the final demonstration must rest with the bureau or the navy yard. However, the practicability, in so far as the means at hand permit, should receive most careful consideration before the recommendation goes forward, and the mechanical or structural difficulties to be over-

come and the interferences to be removed should be clearly defined even though the means cannot always be suggested.

The estimate of the cost of the alteration must, in general, be made by the navy yard, since this work requires an inspection of the local conditions, the preparations of plans and calculations, use of records and data, knowledge of output of machines and men, pay of workmen, and cost of materials.

The above suggests two distinct steps in presenting an alteration for final approval: (1) proof of necessity and preliminary demonstration of practicability; (2) final demonstration of practicability and determination of cost. In taking the first step, the item should be considered for the ship recommending; then for the division, and finally for the fleet.

In order that the work of performing the second step may be saved whenever possible, it is desirable that the item should be submitted for preliminary approval upon the completion of the first step. If preliminarily approved, the second step may then be taken and the item submitted for final approval.

It is desirable in all cases that the approval should be by central authority and not by local authority. This is necessary in order that military, mechanical, structural, economical and sanitary standards and principles be maintained.

The above discussion suggests a routine for submitting recommendations for alterations somewhat different than the present practice.

The commanding officer submits the recommendation to the division commander, defining it as clearly as possible, stating the objections to the present installation and the advantages of that recommended, showing the necessity for the change and demonstrating its practicability.

The division commander examines into the matter and submits this letter for comment and recommendation to other commanding officers of his division, who recommend as to the necessity and practicability of this alteration on the vessels under their command.

The division commander then submits a letter to the commander-in-chief, recommending for each ship of his division.

The commander-in-chief submits the matter to the commanders of other divisions who take it up with their commanding officers, each commanding officer in turn submitting recommendations to

the commander of his division, and the commanders of divisions to the commander-in-chief.

The commander-in-chief considers the matter and submits a recommendation for the fleet, pointing out the differences in the requirements of the various ships. This recommendation goes to the bureaus concerned for preliminary approval, based on bureau standards.

The bureaus having approved, the alteration is sent to the various yards "preliminarily approved, subject to considerations of practicability and cost." This preliminary approval may be accompanied by type plan.

The yards draw up plans and estimates and submit for final approval to bureaus.

The bureaus pass upon and make final recommendation to the department.

The department gives final authority and the yards are directed to proceed with the work.

The original letter of the commanding officer does not go beyond the division commander; the letter of the division commander does not go beyond the commander-in-chief. The bureau, the department, and the navy yard, are thus saved the great burden of considering the letter of each commanding officer separately, and consider merely a single letter for the fleet, with certain recommendations applying to each class of vessels. In this connection, it should be borne in mind that an alteration that is proper for one vessel is proper for all vessels of the class.

We are thus assured that the views of each commanding officer will receive the full consideration of all commanding officers, division commanders, and the commander-in-chief; and when a recommendation for alterations comes forward it will mean that the necessity is pretty generally felt by the fleet. Alterations are thus considered fully by those charged with operations and by those charged with the design and maintenance of standards; and the preparation of detailed plans and estimates involving so much work and expense is reduced to a minimum. It is extravagance to waste time on estimating upon items which will be disapproved from other causes than the question of expense. Such cases may be: (1) violation of engineering or architectural practice or principles; (2) insufficient funds under the appropriation, requiring that the item be carried over for another year; (3) departure

from departmental policy as regards the extent of alterations to be: (1) violation of engineering or architectural practice or military or other designs, developed or contemplated; (5) reasons for requesting not sufficiently good; etc.

There is given below a list of fifty alterations which have been requested by various ships. While this list is by no means complete, it is fairly representative and typical; the items being taken at random without regard to the class in which they fall. The list represents the total number of different alterations included in several ships' letters, no items having been omitted for the purpose of influencing the lists. There may be some question as to the proper class of each alteration but the classification given is made after a consideration of not only the title of the alteration but of the result obtained by making it as well.

In the following table, attention is invited to the percentage that each class forms of the whole.

Military alterations form a fairly high percentage, though not as high as might be expected. In general, the necessity for military alterations increases with the age of the ship, provided it is desired to keep it on equal footing with later ships. To the same or greater degree, the advisability of military alterations decreases with the age of the ship, because the changes necessary to keep her up to date become greater as departures from her type become more radical. Shortly, the cost proves greater than the advantage gained, and she is permitted to fall below the standard and pass out of the first line for economic reasons.

The necessity for mechanical and structural alterations should be greatest in a short period immediately after the first commissioning of the ship. No attempt is made here to fix definitely the length of this period, but six months would seem a reasonable time in which to develop mechanical and structural defects. After this period, the only alterations of this character should be those due to the invention or development of improved apparatus; and the wisdom of making these is dependent largely upon the extent of the gain and the age of the vessel. In general, it should be true that any apparatus which has served the purpose for a number of years should not be replaced by some newly developed apparatus for no other consideration than mechanical or structural improvement or perfection. There should be some accompanying military or economic gain.

Alterations to Various Ships	Military	Mechanical	Structural	Economical	Sanitary	Convenience and comfort
1. Foundation for evaporator pump	..	..	1	..	..	..
2. Ammunition rails	1	..	..	..	..	..
3. Change in boat stowage 40 ft. steamers	1	..	..	..	..	..
4. Enlarge butcher shop	..	..	..	..	..	1
5. Wearing plates under coal hatches	..	..	..	1	..	..
6. Ammunition trolleys	1	..	..	..	..	..
7. Evap. room drain to sanitary line	..	..	..	..	..	1
8. Firemen's wash troughs	..	..	..	1	..	..
9. Ventilation isolation ward, etc	..	..	..	..	1	..
10. Rehinging hatches	..	..	..	..	..	1
11. Balance gear on eng. room hatches	..	1	..	..	..	..
12. Metal uprights in magazines	1	..	..	..	..	..
13. Rearrange bakery shelving	..	..	..	..	..	1
14. Change coal box in bakery	..	..	..	..	..	1
15. Galley warming oven	..	..	..	..	..	1
16. Draft gauges	..	..	..	..	..	1
17. 3-inch guns shifted	1	..	..	..	..	..
18. Closing smoke hatches	1	..	..	..	..	..
19. Voice tubes torp. defense	1	..	..	..	..	..
20. Plotting and subs. rearrangement	1	..	..	..	..	..
21. Cold-storage rearrangement	..	..	..	..	..	1
22. Drains and scuppers	..	..	..	..	..	1
23. Eductor for after bathrooms	..	1	..	..	..	..
24. Ventilation of brig	..	..	..	..	..	1
25. Ventilation of torpedo rooms	..	..	..	..	..	1
26. Bread locker	..	..	..	..	..	1
27. Change location of life buoys	..	..	..	1	..	..
28. Battle dressing station	1	..	..	..	..	..
29. Bridges and director station	1	..	..	..	..	..
30. Storage battery room	..	..	..	..	..	1
31. Magazine sprinkling	1	..	..	..	..	..
32. Oil stowage	..		..	..	..	1
33. Chafing plates under hawse pipes	..	..	..	1	..	..
34. Removing ram plates	1	..	..	..	..	..
35. Electric steering gear	..	1	..	..	..	..
36. Remove fire-proof wood and furniture	..	..	..	..	1	..
37. Additional coal scuttles	..	..	..	..	..	1
38. Blower foundations	..	..	1	..	..	..
39. Central station	1	..	..	..	..	..
40. Remove torpedo tubes	1	..	..	..	..	..
41. Searchlight platforms	1	..	..	..	..	..
42. Range-finder platforms	1	..	..	..	..	..
43. Ammunition hoists	1	..	..	..	..	..
44. Ventilation of substations	..	..	..	..	1	..
45. Cross connections in water service	..	..	..	..	..	1
46. Location of compass and steering wheel	..	..	..	..	..	1
47. Additional lockers and shelving	..	..	..	..	..	1
48. Turret officers' booths	1	..	..	..	..	..
49. Turret gear changes	1	..	..	..	..	..
50. Gas ejecting	1	..	..	..	..	..
Totals	20	3	2	4	3	18
Per cent	40	6	4	8	6	36

Economical changes result from the improvement in apparatus or material which produces more efficient operation or better wearing qualities. Such changes are always welcome and are most advantageously made when the old has worn out.

There is some danger of sanitary changes being made too readily, as it is hard to resist anything brought forward in the name of sanitation. It is to be noted that the percentage is small for so worthy a cause.

Convenience and comfort: There is quite a little personal feeling and opinion in this class of alterations. What one man feels as necessary may not appeal to another as such. In general, the necessity and advisability of such alterations should decrease with the age of the ship. Inconvenience and discomfort of a serious nature will be removed in the early days of commissioning, and those which require eight or nine years to discover cannot be very serious.

There may be some confusion or difference of opinion as to which class the various alterations belong. This is due chiefly to the tendency to consider them all military, in that they constitute alterations to a military instrument, and, regardless of the cause for their necessity, tend to increase the military efficiency. The military alterations should be considered as limited to those which change the strictly military features of the ship.

The purpose of the above is to suggest a uniform, standard method of considering alterations, to ensure that alterations will receive full and proper consideration by all concerned, that standards will be maintained, that data may be collected and preserved for future designs, that the action on one ship may be made general for all ships to which it applies.

Perhaps the most important feature is the more general consideration of alterations by those charged with operation. In order that this feature may be further developed, it is suggested that there be organized a "Fleet Board on Alterations," composed of the fleet staff, namely, the fleet engineer, fleet ordnance officer, fleet paymaster, fleet medical officer, and fleet naval constructor. This board to meet periodically to investigate and consider proposed alterations, making recommendations to the commander-in-chief. The findings of such a board should represent the actual needs of the service and should assist materially in standardizing and perfecting our ships, and the development of future designs.

THE NUMBER OF OUR NAVY YARDS.

The purpose of our navy yards is two-fold:

1. *Industrial.*—The economic accomplishment of repairs and alterations to our fleet in peace times so as to keep it in a condition of constant preparedness for war.

2. *Military.*—The expeditious docking and repair of our fleet in war time so as to keep it constantly ready for action.

If we consider only the first purpose, namely, the economic maintenance of our fleet in peace times, I think that there can be no escape from the conclusion that we have too many navy yards. Since all of the yards must be equipped for general work and cannot specialize, it is certain that consolidation will effect economics as it has in so many lines of private industrial enterprise.

The problem of building up a single navy yard capable of replacing three or four of our present yards is such an enormous industrial undertaking that it would doubtless be many years before the full benefits would be derived from the consolidation. The choosing of the site is, in itself, a problem of considerable magnitude. Its location in the neighborhood of our large cities is practically prohibited by the value of land along the waterfront and the increasing demand for this land for commercial purposes. Our large sea-coast cities are already calling for more dock space. Thus forced to some undeveloped locality, it means that we must build not only a navy yard but a city, since there will be some 12,000 to 15,000 men to house. The labor problem will be somewhat complicated by the fact that such a yard cannot furnish steady employment to its maximum number of men and must therefore draw on the labor of surrounding industries. If there are no surrounding industries, we must at some time be embarrassed by the absence of sufficient competent labor to even a greater extent than at present. Navy yards have frequently urgent calls for commercial material, at which time it is quite convenient to be near the market for such.

A problem deserving serious consideration in our navy is the granting of leave to our enlisted men. It is not sufficient to spend a week or so each year in the vicinity of a large city where the men can find pleasure and recreation. We must have liberty periods as regularly as we have drill periods or repair periods. Now, in order that too much time may not be lost from drills and

manœuvers, it is desirable that the liberty period coincide with the repair period. Liberty can best be given in a large city where the men can find sufficient amusement and entertainment to keep them from dissipation and vice. This forms, then, an argument in favor of locating our navy yards in the vicinity of large cities.

The site chosen must be amply fortified, as it will become a point of great military value in war time. In order that the expense of building new fortifications may not be prohibitive it is desirable that a site be chosen which is already fortified. It is doubtful if an available one can be found that is amply fortified. It may develop that the capital invested in new fortifications and the expense of maintaining them will more than absorb the saving to be effected by the increased industrial efficiency resulting from the consolidation. The matter of fortifications is, of course, on the military side of the question, but the expense of such fortifications forces us to consider them along with the economic industrial problem.

We will suppose then that the industrial problem has been solved; that a site has been found which is suitable; that the economics gained by consolidation outweigh considerations of poor labor field, and distant material market; that the cost and maintenance of increased fortifications still leaves a balance and we have decided to move.

Let us pause and consider the second purpose of our navy yards: "Expeditious docking and repair of our fleet in war time."

War breaks out. Industrial economy is lost sight of in the frantic call for military expedition. If our navy yards have fulfilled their peace-time function and our preparedness is real, there should be no mad rush in the early days, except the destructive work of removing a little top hamper and peace-time conveniences. Dry docks and coaling stations are somewhat in demand; stores are needed quickly and in great quantity. In order to save time, all these things should be done at once and not in sequence; and with our whole fleet or half our fleet assembled in one navy yard it will be a busy little place, and consolidation will begin to show a few disadvantages.

But the real test is not yet. A modern war between two nations of about equal naval strength will scarcely be decided in one engagement. The first tilt having been decided, the problem is to prepare for the next. The contestant that can repair its fleet and

assemble it on the firing line in the shortest time has an enormous advantage. A few days at this time mean the enemy's commerce, the establishment of an effective blockade, the capture of some important strategic point; in fact, may decide the war.

Our crippled fleet returns, a demolished conning tower to rebuild, a few turrets jammed, a few guns to be replaced, a mast to be rebuilt, a number of holes to be patched, armor plates to be replaced, power leads and pipe lines to run—in all, an enormous volume of work to handle in the shortest possible time. Dry docks, piers, cranes, tugs, barges, coal, stores, men, power, material, and above all, *time* will be in demand. Can it possibly be argued that under such circumstances we would find a single large navy yard preferable to three or four smaller ones? It seems self-evident that confusion could be minimized and time saved by distributing this great volume of work, that expansion to meet the call could better take place at four points than at one. We can here apply to an exaggerated degree the argument of certain traffic experts who claim that large volumes of traffic are more expeditiously and comfortably handled from a number of properly distributed stations than from a single large station. One need only struggle along the approaches to any of our large railroad stations in rush hours to be convinced of this.

I venture to state, therefore, that military expedition in war time demands distributed navy yard strength as opposed to consolidated navy yard strength.

Let us consider another emergency that might result from the first or subsequent engagement of opposing fleets. The enemy's fleet breaks through; our fleet is pushed aside and left in crippled condition; the victor presses his advantage and proceeds to the attack and capture or destruction of our consolidated navy yard. We are embarrassed and find "all our eggs in one basket" and the situation becomes quite serious. How much more secure we would be with our navy yard strength distributed to four or more points, each lying secure behind the fortresses that defend our cities!

Suppose under a plan of consolidation we substitute one navy yard for two. It would then be as easy to deprive us of our whole navy yard strength as it had been to deprive us of half our navy yard strength.

It may be argued at this point that with a number of navy yards

it is necessary to separate our fleet into an equal number of units in order to effect repairs, and that with such a divided fleet the enemy could attack and demolish each unit in turn. It should be borne in mind, however, that in an engagement between two modern navies it is scarcely possible that either of the contestants could escape without the loss of a number of ships and the more or less serious crippling of all of them. In other words, each side will be materially weakened by the encounter.

Suppose that the enemy's fleet is in such condition that they need send only half of their remaining ships for repairs, whereas our own is so crippled that all must seek repairs and that for this purpose we break it into four equal units, each going to a different navy yard. This would leave the enemy with half its strength with which to bottle up any fourth of ours, but as our enemy's base could be no nearer than Europe, it is highly probable that our fleet would be first to return to the firing line. This would mean three-fourths of our strength with which to attack one-half the enemy's, and with such an engagement on it would not be difficult for the remaining fourth to render assistance.

I believe, however, that after an engagement in American waters no naval power in the world would be in a condition to proceed with the bottling up or destruction of any part of our force without first seeking repairs or coal. If this be true, it is really a problem of "coming back" and the one that can come the swiftest and surest has all the advantage.

The above is not intended as an argument for retaining our useless navy yards. There can be no doubt that a number of our smaller yards are useless and should be abandoned, as they would serve no more useful purpose in war time than they do in peace time. Neither is this a plea for any particular yard or number of yards, but rather is it intended to point out the possible danger of too great a consolidation, based on consideration of industrial economy.

When we consider then that the economic industrial advantages of consolidation are much diminished, perhaps made negative by the necessity for military defence, and that the necessity for military expedition in war times outweigh all considerations of economy in peace times, and the possibility of losing our entire navy yard strength by the fall of a single stronghold or two, we must be convinced that the principle of consolidation on the ground of economy is short-sighted and disastrous.

I would enter a strong plea for the principle of distribution as opposed to consolidation in this instance. New York, Philadelphia, Norfolk and Boston each have a well established navy yard, amply protected by the defences of the city. To abandon any one of these is an evident weakening of our naval strength. Let the number of navy yards be decided upon military considerations, based on the number of units in which our fleet would naturally divide for emergency repairs, and having fixed the number, then proceed to make them as nearly equal as possible by a proper proportioning of the manufacturing and repair work in peace times, carrying it even so far as to distribute the shipbuilding among the different yards, so far as facilities established by military considerations will permit.

One large navy yard rushed with work and three small ones slack of work is an unbalanced condition of affairs, just as a fleet would be composed of one big, powerful, speedy ship and three smaller, weaker, and slower ones.

DISTRIBUTION OF WORK TO OUR NAVY YARDS.

It is the general policy of individuals and business houses to buy where they can buy the cheapest. Some are wise enough to consider the quality as well as the price and buy where they can buy the cheapest, consistent with the desired quality, or, better still, the *necessary* quality. Others, whose tastes are extravagant and means plentiful, insist upon paying a fancy price, firm in the belief that the highest-priced article is always the best. And in honest business it should be so, and, efficiencies and profits being equal, it *is* so. But the quality may be higher than necessary and the high price paid unwarranted by the conditions under which the purchase is made. There can be no doubt that the correct policy for the government, as well as for individuals, is to buy the article of *necessary* quality at the lowest obtainable price, provided the only consideration is the economic purchase of the article. It may develop, however, in certain lines of the government's business, that other considerations than the economic purchase of an article enter into the problem of obtaining it. This is true of such articles as are manufactured in our navy yards and of such work as is done there.

The government is here both consumer and producer. As consumer, it is interested primarily in the cost of the article; as

producer, it is interested primarily in the efficiency of the plant. I desire to point out the relative importance of (1) the cost of the article; and (2) the efficiency of the plant; and to demonstrate that the purpose of our navy yards being the economic maintenance and expeditious repair of our fleet in peace and war times, the question of increased efficiency in the accomplishment of this purpose is of such vast importance that the low cost of any particular article is of relatively minor importance; that in distributing work we should consider the effect of such distribution on the general efficiency of our navy yards rather than the low cost of the work.

Work is to the navy yard what ammunition is to the fleet; it is the instrument by which the yard is trained to higher efficiency. It is just as important that the navy yard should have a uniform allotment of work suited to its equipment as it is that the fleet should have a uniform allowance of ammunition suited to its guns.

Let us remember that certain navy yards are forced upon us by military considerations. These navy yards must be sufficient in number and capacity to handle our war fleet quickly in the event of an emergency, and in order that each yard may handle its share of the ship repairs it is necessary that all yards be fully equipped for performing all classes of work; that is, each must have a fully equipped joiner shop, shipfitter shop, smith shop, machine shop, foundry, pattern shop, etc. In order that the yards may perform efficiently the function for which they are primarily designed and maintained, it is necessary that they be kept operating in all lines of work for which they are fitted at as great a capacity as the normal work required for the maintenance of our fleet will permit. In order that the machines may be maintained in efficient condition, it is necessary that they be kept in operation. In order that they may be operated efficiently it is necessary that there be enough work for them to permit of the training of men for their operation; and in order that such trained men may be on hand when required we must offer them reasonably steady employment so that they may be induced to work in our navy yards and maintain their homes in the vicinity. It can well be imagined that a fully equipped navy yard might fail to perform its function at a critical time by reason of the unused, inactive condition of the machines, or the lack of competent operators to run them. At such a critical time, competent operators are necessary,

not only for obtaining low costs of production but also for expediting the urgent work that is at hand. Efficiency of the plant and of the workmen means, therefore, not only low costs but expedition.

So it appears that the practice of awarding particular classes of work to particular navy yards on the basis of the lowest bid may be in error and may lead to very low total efficiency and to an utter failure at a critical time.

In our present state of organization, the practice may be objected to for the reason that many of our estimates are quite unreliable, being made by foremen or others who realize that the work will be awarded on the basis of the lowest estimate and who therefore reduce their estimates below their warranted amount, for the purpose of obtaining such work. This is not stated to be the practice, but is stated as a possibility under the present conditions. If awards are to be made on the competitive basis they should not be made from a comparison of bids, but rather from a comparison of returned costs obtained from different yards where an equal amount of the same class of work has been performed in accordance with standard specifications and with full knowledge that the cost of such work will furnish the basis for its award in the future. Such a practice might be considered as truly competitive, in that it would give all yards an opportunity to devote their attention to increasing the efficiency of the particular manufacturing operation involved, and would stimulate the officials and the workmen, as competition along any line usually does.

It may develop, however, that the attention devoted to the particular article or operation for the purpose of reducing its cost will result in a lack of attention to some very much more important article, or operation on which there is no competition, and that to place the yards on a competitive basis will not result in increasing the efficiency in the broad, general sense that is desired; and I wish to invite attention to an alternative method of awarding the work that will perhaps result in a higher average efficiency.

As pointed out above, we are obliged to maintain a certain number of navy yards of a certain capacity. Suppose then that we assign to each of these yards a figure for each class of work, which shall represent the normal capacity of that yard for that class of work. A number of different ways might be suggested for obtaining this figure.

(1) It might be on the basis of the number of ships normally assigned to that yard for repair;

(2) It might be on the basis of the number of ships that would probably be assigned to that yard for repair in the event of an emergency, such as war;

(3) It might be on the basis of capital invested in such plants.

(I do not intend to go into a discussion of which of the methods of determining this figure is the best; but it may be mentioned that as the yards are designed for emergency rather than normal conditions, they are nearly equal as regards the capacity of their plants or the capital invested in such plants, and that a more reasonable figure would probably be obtained by considering the normal amount or the emergency amount of work assigned to various yards.)

Having determined such a figure, work would then be assigned to that yard which required it for the maintenance of its normal working force, each yard receiving its proportion of the work according to its assigned figure.

Suppose, for instance, that the canvas work to be allotted for any particular period were represented by 1000 hammocks, and that the figure for the New York, Norfolk, Philadelphia, Boston, and Portsmouth yards were respectively, 10, 9, 8, 7, and 6; then New York would receive 10/40, or 250 hammocks; Norfolk, 9/40, or 225 hammocks; Philadelphia, 8/40, or 200 hammocks; Boston, 7/40, or 175 hammocks; and Portsmouth, 6/40, or 150 hammocks. Having assigned the work in this proportion, the competitive feature, which stimulates individuals and organizations toward efficiency, might be obtained by publishing a bulletin or letter which detailed the allotments of work, and when the work had been completed, publishing a second bulletin or letter in which the costs of the hammocks at the various yards would be given, which comparison would be on the basis of direct labor, since this is the true basis of comparison. Each yard would thus have brought to its attention, in comparison with other yards, the output of hammocks per man per day, and if any yard continued to be inefficient in some particular line it could be directed to investigate and determine why its output was below that of other yards. The least efficient yard would thus be given an opportunity to attain the standard of the most efficient. This appears to be more truly competitive in effect than the system of awarding all

the work to the one yard offering the lowest bid, since the latter system really stifles rather than promotes competition; for a yard having bid somewhat high on an article is given no opportunity to increase its efficiency, but is cut off from all work of that nature by reason of the total award having been made to the lowest bidder. Thus, it may develop that yard No. 1 would make a higher bid for hammocks than would yard No. 2. These hammocks having been awarded to yard No. 2, the sail-loft work in yard No. 1 would be greatly reduced, which reduction in work would result in a reduction in force, which reduction in force would lead to a lower efficiency in the matter of performing the work yet remaining in that yard. We will say, then, that yard No. 1 still has an order for hospital tents. A short time later bids are called for on hospital tents. Yard No. 2 has been running its sail-loft to capacity by reason of its recent success in obtaining the order for hammocks, and is, therefore, in a more active and more efficient condition than yard No. 1. Yard No. 2 is again the lowest bidder and is awarded the contract for hospital tents, which again results in higher efficiency for that yard and a lower efficiency for yard No. 1. If carried to the limit, this means that yard No. 1 will be driven out of the sail-loft business, and the canvas work will be concentrated in one particular yard. We have thus attained efficiency in canvas work at that particular yard, but to do so have sacrificed all the other yards, and there is no longer any competition; yet we must maintain a sail-loft at each of those other yards in order that repairs may be made to the ships assigned to them; but when the ships leave the yard they take their work with them and we have no work with which to maintain our force. The men are discharged, seek employment elsewhere, and eventually leave the vicinity.

If work is distributed to various navy yards with a view to providing a uniform amount for each so as to maintain a fairly steady working force in the various trades, based on the normal capacity of the yard, it will result in adding to the positions the inducement of steady work, which appeals to the right class of men, and it will thus be possible to keep men steadily in the employ of the government and train them to the particular work for which they are adapted. One of the most serious considerations in the employment of labor at navy yards is the lack of *steady* work, causing abnormal fluctuations in the size of the force, and discourag-

ing men who are desirable, since they work constantly with the fear of discharge hanging over them and are quite ready to accept positions at private establishments when opportunity offers. If it can be brought about that each navy yard can be assured a certain reasonable quantity of work and thus enabled to maintain its normal force steadily, it will result in a great increase in the efficiency of all work done; and the gain to the government will undoubtedly be greater than is the gain attained from awarding work on the basis of competitive bids.

It is the competitive bid principle which has so successfully eliminated the small plants and dealers from the industrial world and promoted the growth of corporations and monopolies, since it is a well-known fact that large companies are in the habit of bidding lower than production costs would warrant for certain business on which they have to compete with similar or more special establishments. They are willing to lose money where they have competition and to make it up where they have a monopoly. While the consumer has probably profited up to the present time and been able to obtain certain articles cheaper than formerly, in the end the average price paid for all commodities will be higher than would be the case were monopolies not made possible.

This is not exactly analogous to the situation of our navy yards, but suggests one of the dangers of over-competition, namely, the elimination of the unsuccessful bidder. We have established our navy yards for military reasons, and for military reasons cannot afford to eliminate them. If it is admitted that we must maintain our navy yards in a condition to carry on all classes of work, then surely it will be admitted that they will all be kept in a healthier, more active and more efficient state if each is furnished with a sufficient amount of the various classes of work to keep its normal force busy. In order that this may be done, the manufacturing work must be allotted to the various yards in such manner as to furnish them employment in the absence of repair work.

Lieutenant-Commander Lyman A. Cotton, U. S. N., in an article in the PROCEEDINGS OF THE U. S. NAVAL INSTITUTE, on "Competition *vs.* Character" has pointed out some of the dangers of competition as applied to our service. A portion of this essay is quoted herewith:

> Competition is unquestionably a stimulant, and avowedly so administered to our Service but it is feared that we are actually trying to keep our

quondam patient alive by this stimulant. Louder and more insistent grows the cry for more and still more competition and more and more neglected are the non-competitive features that enter into naval efficiency, until their very importance is forgotten and their utility denied. . . . . In the branch of gunnery, competition has reached its most violent development. As the time for target practice approaches, interest in the competition (not necessarily in gunnery) increases until all else is lost sight of in the one possessing idea of standing well. As our competition is conducted and emphasized, the desire to win is inordinately stimulated alike by the vanity of the officers and the cupidity of the men, until in many cases it becomes such a passion that erstwhile good judgment is so warped that prudence and discretion are thrown to the winds. Small wonder that competition and accident have so frequently gone hand in hand. As soon as the practice is over the artificially stimulated interest collapses like a punctured balloon and the art of gunnery languishes until the approach of the next gunnery practice.

However, some of the bad results of too violent competition follow close upon the heels of target practice. Insinuations, jealousies, disputes, and protests are belched forth *ad nauseam*. . . . . The enlisted personnel of our Service is in a constant state of change, and is replenished largely by young, impressionable, and untrained men, and to a lesser degree the same is true of the commissioned personnel. These young men receive their most vivid impressions of the Service through the competitions in which they take part. All stress is laid upon these competitions purely as competition and everything else is relegated to the background of unimportance. Every appeal is made to vanity and cupidity, the twin foci of the ellipse of competition about which, as centers, so many of the evils of competition revolve. It is not surprising that one who does well in competition magnifies his own importance out of all proportion to the true case. He puffs himself up, much as does the star player upon some minor college team, until the very success of the team is held in his hand and subject to his very caprice. He holds himself to be superior to his fellows and not subject to ordinary rules and regulations. The indispensable man should not be tolerated aboard ship, and a man, though qualified through competition, may thereby be ruined as a military asset.

Restrain and control competition. Make it serve as a means instead of an end. Do not sacrifice anything important to competition. Keep down artificiality. Do not attempt to grade all competitors with exactitude. If a ship be excellent in gunnery or very good in steam engineering, it is quite enough that she know this, without attempting through some more or less artificial standard to express just how excellent she is or just where she comes among all those that are very good. Allow all the crew of an excellent ship to wear some badge of honor, as an "E" upon their sleeves or a colored cap ribbon, but do not attempt to buy war efficiency with dollars and cents.

It is perfectly conceivable that in encouraging competition along certain lines at our navy yards, the officers and foremen would devote their time to "making good" and sacrifice con-

siderations of general efficiency to considerations of obtaining the award of certain classes of work. At the present time we are in need of a broad, general improvement in efficiency rather than improvement in the efficiency of some particular operation, and our energies should be directed toward an improvement in our organization and general methods.

The mistake is sometimes made of thinking that competition has some value other than a stimulating effect. Competition does nothing more than direct our energies toward some particular matter which shows up unfavorably in comparison with the same matter at other yards. Thus it may develop that through competitive bids we learn that yard No. 1 is able to manufacture furniture cheaper than yard No. 2. Such information merely suggests to yard No. 2 that the manner of manufacturing furniture requires attention but it does not suggest in any way the manner in which yard No. 2 can improve its efficiency. In order to arrive at the improvements necessary, yard No. 2 must investigate thoroughly the various operations of manufacturing, then proceed to their improvement. The same result could have been obtained without competitive bids, since such are not necessary to direct the energies of those in charge of navy yards toward the improvement of conditions; for if we have the knowledge or belief that conditions are good or bad, we can readily determine for ourselves by a process of investigation leading to improvement, and when conditions have been improved and standardized the use of the time-study to get at the efficiency of the men can be undertaken.

The mistake is sometimes made of considering efficiency only as a relative quantity; that is, the efficiency of one yard is compared with that of another. Figures obtained in such a manner may be misleading, and it is much more valuable to consider efficiency as an absolute quantity, having a maximum represented by 100%. By a study of the operations it is determined that some losses are due to conditions, some due to methods, some due to incompetency; all of which lower our efficiency. These losses can easily be assigned an absolute value, and their elimination increases our efficiency to that extent.

Competition as applied to our navy yards should consist in a comparison of the costs of various classes of work at the different yards, but should not extend to the awarding of contracts on the

basis of competitive bids. Such a process, if carried to the end, eliminates competition entirely by concentrating particular work in one yard. This is prohibited by military considerations and should therefore not be encouraged by any system opposed to it. The problem is to make all of our navy yards as efficient as possible in the classes of work which they are called upon to do. A one per cent improvement in the general efficiency represents a greater absolute gain to the government than a ten per cent increase in efficiency in some particular operation.

The above outlined policy should not be considered as forbidding the concentration of the manufacture of a particular article in one navy yard, provided you allot similar work to other yards in the proportion necessary to maintain their normal working force in that line. It should be noted, however, that as soon as you confine any class of work to one navy yard you no longer have competition, so that the advocates of competitive awards will quite naturally work themselves out of material for carrying out their policy.

The arguments in favor of a properly proportioned distribution apply more strongly to work of a military nature than to work of a non-military nature. For example, in the event of an emergency it may be of no importance that we have been left without an efficient sail-loft, but it would be of great importance if we were left without an efficient and adequate shipfitters' shop, smith shop, or machine shop. While the military work in times of emergency will be mostly repair work, yet it must be borne in mind that a repair job, when analyzed, is for the most part made up of standard manufacturing operations, and it is the manufacturing work in quiet times which enables us to tone up the shop required to do repair work in an emergency, for upon the manufacturing job we have time to plan and study and to develop certain standard conditions, methods and outputs, which will apply alike to the manufacturing operations of repair jobs, increasing their efficiency of performance, both as regards cost and expedition. For example, the training given a lay-out gang, a punch-and-shearing gang, a riveting gang, the move-man, the various functional foremen in a shipfitter's shop in the manufacture of a tank, signal locker, bread locker, or other like article, properly planned and routed, will effect surprising economies in the time and cost of getting out the structural work necessary to

repair damage to a ship of a military character. The training given the management and men in handling one job properly is felt in increased efficiency in the handling of all jobs that follow. It is an improved tone, a broad, general increase in efficiency that we are after.

(The arguments advanced above might be applied to the broader, more important and general problem of the relative size and number of our navy yards. While it might be an economic policy to increase the size of one navy yard at the expense of the others, by concentrating work there, yet it might have a disastrous policy in the stress of war should that navy yard be taken or destroyed. It is better, therefore, to fix upon a certain number of navy yards necessary for military reasons and then to try to make them as nearly equal as possible by a proper proportioning of the manufacturing and repair work in peace times, carrying it even so far as to distribute the ship-building among the different yards, so far as facilities established by military considerations will permit. One large navy yard rushed with work and three small ones slack of work is an unbalanced condition of affairs, just as a fleet would be composed of one big, powerful, speedy ship, and three smaller, weaker, and slower ones.)

In the above paper, it is intended merely to suggest that in the establishing of our navy yards and the allotment of work to them, their purpose and reason for existence should be borne in mind, and small gains and economies should not blind us to the broad, general efficiency that should be the first aim. The problem is not how and where to get a ditty box the cheapest, but how and where to maintain our fleet the cheapest. Anything which lowers the general industrial efficiency of our navy yards is a poor military policy.

It is no more logical to award the work to our navy yards on the competitive basis than to award the allowance of ammunition to our ships on the basis of which made the most hits at the last target practice. Suppose we should say: "The ship that makes the most hits this year will do *all* the firing next year. The shop that does the cheapest work this year will do *all* the work next year."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

OUR NATIONAL FLAG.

A SHORT HISTORY OF ITS DEVELOPMENT. ITS LACK OF UNIFORMITY IN GOVERNMENT DISPLAYS. SENTIMENT OR SENTIMENTALITY IN ITS USE.

By CAPTAIN W. F. HALSEY, U. S. Navy.

Having for a number of years among other duties that of the issue to vessels of the service of flags and jacks of standard dimensions it was found most instructive and interesting to note the changes and development of the flag from the time when proportions were established by the naval commissioners in 1818 until the present date. Congress on returning to the original thirteen stripes from the existing fifteen stripes passed an act, that was approved April 4, 1818, which read as follows:

AN ACT TO ESTABLISH THE FLAG OF THE UNITED STATES.

SEC. 1. Be it enacted etc. That from and after the fourth day of July next, the flag of the United States be thirteen horizontal stripes, alternate red and white; that the union have twenty stars, white in a blue field.

SECT. 2. And be it further enacted, That on the admission of every new State into the Union, one star be added to the union of the flag, and that such addition shall take effect on the fourth of July next succeeding such admission.

While the color and number of the stripes were legalized, together with the color and number of stars in the field, there was no law passed or details given as to arrangement of stars, sizes of field, or relative dimension of a standard flag. Apparently these important points were overlooked, but for the navy were covered by the following circular:

NAVY COMMISSIONERS OFFICE, MAY 18, 1818.

SIR,—The Navy Commissioners have to inform you that agreeably to the Act of Congress on the 4th of April 1818, entitled *An Act to Establish the flag of the United States*, our national flag is, and from after the the 4th of July next, to be: Thirteen horizontal stripes, alternate red, and white. The union to be twenty stars, white in a blue field, one star to be added on the admission into the Union of every new State; such addition to be made from and after the 4th of July next, succeeding the date of such admission.

The size of the flag must be in the proportion of fourteen feet in width and twenty four feet in length, the field of the union must be one third the length of the flag, and seven thirteenths of its depth, so that from the top to the bottom of the union there will be seven stripes, and six stripes from the bottom of the union to the bottom of the flag. The manner of arranging the stars you will perceive by the subjoined sketch.

The upper and lower stripes to be red.

Respectfully,

(Signed) JNO. RODGERS, President.

The Officer Commanding, The Navy Yard, Portsmouth, N. H.

In the sketch to which reference is made the twenty stars were arranged in four parallel lines, five stars in each line, the stars being staggered. On September 18, 1818, a second circular was issued changing the arrangement of the stars so they appeared in four parallel lines, of five stars each, the corresponding stars in each row arranged in a vertical line. The latter arrangement has practically obtained in order to have the necessary space. With the admission of new states, and consequent addition of stars, it became desirable on the score of symmetry to make certain changes in relative proportions of the flag. The first systematic and definite official orders on this subject were probably issued by Mr. Chandler as Secretary of the Navy in 1882, and appear in the allowance book of articles under the cognizance of the Bureau of Navigation, which bureau was at that time charged with the issue of all flags to the naval service. In this allowance book the size of the union was increased from one-third to four-tenths the length of the fly, and the width (hoist of flag) was changed to 10/19 the length of the fly. Eight standard sizes were adopted, numbered respectively from one to eight, number one the largest with a hoist of 19 feet, and a fly of 36 feet, number eight the smallest boat flag being 2.37 feet by 4.5 feet.

Subsequently to this date the manufacture of all flags was transferred to the Bureau of Equipment, and on September 30, 1891, Admiral George Dewey, then Chief of Bureau of Equipment, directed further detailed standardizing of naval national flags, and added an additional number ten boat flag, to be attached to the sails of boats when maneuvering or drilling under such conditions. To preserve the identity of the stars in the flags and unions it was necessary that they should be of moderately large dimensions, and with a view to obtaining uniformity in the sizes of the stars and their position in the union certain dimensions were adopted, also a method applicable to all sized flags by means of which the position

of the center of each star could be absolutely obtained. For flags below number five storm (hoist 5.14 feet, fly 9.75 feet) the unions were to contain only thirteen stars. These dimensions and arrangements have continued in the naval service practically to this date, save only the additional stars necessitated by the admission of new states. For union jacks the sizes were automatically obtained from given dimensions of the national flags. The jack formed one of a pair of colors and was designated by number. That is number one jack was flown with number one flag, or number five jack with number five flag, and the dimensions of such jacks were those of the respective unions of the flag with which they were paired.

In recent years the arrangement of stars due to change on admission of new states was referred to a joint army and navy board. This board submitted plans and recommendations which, upon being approved by the President, were issued to the military services by the respective heads of these departments, in general orders. Though such orders have the force of law for these services the fact still remains the same that there is no law of the land enacted by Congress which makes mandatory the arrangement of the stars, or the number of stripes below the union, for the national flag of our country.

Previous to 1866 our flags had been manufactured generally from English bunting, as no domestic texture had been found capable of resisting efficiently the wind and action of the atmosphere. On February 21, 1866, the Honorable B. F. Butler, of Massachusetts, introduced to the Senate the agent of the United States Bunting Company, of Lowell, Massachusetts, who presented to them for the use of the Senate a flag manufactured by the company from bunting of their domestic production. This flag was twelve feet hoist by twenty-one feet fly, and is believed to be the first real American flag ever raised over the Capitol of the United States. A test ordered by the Navy Department proved the American bunting to be of the best quality and fast in colors. Since this date it is required by the military services that all national flags shall be made of domestic bunting, unless impossible to obtain within the United States bunting that shall meet the required specifications. Though the navy specifications are most severe as to weight, wool, tensile strength, number of yarns of which woven, color tests, and sun exposure, no trouble has been experienced in obtaining the desired fabric for the national flag. Flags for the navy are manufactured at the New York, Mare Island and Cavite navy yards,

strictly in accordance with specifications and drawings, and necessary supplies of this equipment are drawn from the yards by vessels of the Atlantic, Pacific and Asiatic fleets. Up-to-date methods of manufacture are followed, with star cutting machines and motor driven sewing machines, and such manufacture offers employment for skilled employees of both sexes. Flags for the army are manufactured at the Schuylkill Arsenal, Philadelphia, where an extensive plant for this purpose is maintained.

While the navy has found by experience the necessity for nine sizes of flags, with changes from the original proportions, the army has been for general service use restricted to post, garrison and storm flags (three sizes only), and in these flags have the uniform length of the union, one-third that of the total fly of the flag, but the dimensions for the fly do not bear the same relative proportions in any two flags. For both services an exception is made in relative proportions in the flag carried by troops, as such flags carried on a pole by the standard bearer were found by experience to require a shortening of the fly to be handled properly by the average man.

Since the establishment of system and economy in administration flags for all government departments, except State, War and Navy, are purchased by the General Supply Committee, which committee as its name indicates is charged with duty of obtaining, with exceptions, the general equipment and items for government use.

The attention of the Secretary of the Navy was called to the fact that there was no standard for our national flag, that while different service would require different sizes, all such sizes should conform in relative proportions. As now existed the army had three sizes, no two of which had the same relative proportions regarding hoist and fly, that the navy had nine sizes of flags, all of which bore the same relative proportions in dimensions, but that the size of the union as adopted for the navy differed from that existing for army flags. Furthermore it was pointed out that for the other departments of the government, the General Supply Committee had contracted for or had issued schedules including flags of over fifty different sizes, in which sizes were radical departures from proportions of either military service.

The head of the Navy Department referred for consideration to each of the other governmental departments the desirability of appointing a representative to confer with the other representatives with a view to reconciling existing differences, and to decide upon

and recommend a standard for the national flag and union jack, to which all flags should conform in relative proportions. It is understood that the suggestion of Mr. Meyer was received with universal approval by the cabinet officers, and that a board consisting of nine representatives has met and submitted a report on this subject.

From all information obtainable it becomes patent that the United States Navy is the only military service that denies to its personnel the honor of being covered by the national flag when buried. The naval regulations are mandatory on this subject and state that the coffin of any officer or enlisted man of whatever rank shall be covered by the union jack. In the sister service, the army, the coffins of their personnel, from general to private, are covered on occasions of military funerals by the stars and stripes. Why the distinction? So far as can be learned it is due to a misunderstanding that crept in early regulations and which misunderstanding has been perpetuated in subsequent issues of the *Blue Book*. Tradition and records point to the fact that in the early publications of naval regulations the requirements of the English service were followed; requirements which generally were most excellent and equally applicable to the infant navy of our country. The English naval regulations indicate that at military funerals the coffin shall be covered by the union jack, and this it is believed is the source from which sprung the custom followed in our navy. But the individual, officer or civilian, who originally copied from the regulations of our cousins across the sea, failed to recognize the fact that the union jack is the national flag of England or now the national flag of the British Empire. On pages 5, 17, and 19, of the British Admiralty publication, *Flags of All Nations*, issued by the Admiralty as official in 1907, will be found the following statements: "National or Union Flag. Established in 1606 by King James the 1st, when the union was made of the banner of St. George of England, and St. Andrew of Scotland, amended by order of the Queen in Council, on April 17, 1707, on report of the Lords of the Privy Council. The present Union Flag of England was completed on Nov. 5, 1800, approved by the King, and the cross of St. Patrick was conjoined to that of the crosses of St. George and St. Andrew."

The publication quoted is authority for the following statement: "It is believed that the term *Jack* is derived from the abbreviated name of the reigning Sovereign King James the 1st, under whose

direction the flag was constructed, and who signed his name *Jacques.*"

Thus the union jack of Old England is the national flag. It is carried by the troops, fought under when occasion requires, is hoisted on all forts and army stations and by all English diplomats and consular authorities, the particular rank being noted by specific badge placed thereon as required by regulations. The so-called union jack of the United States has no legal existence, no statute authorizes its manufacture or describes its use or details. It is a signal flag pure and simple, and through mistaken usage has apparently established the precedent for such flag, neither sentiment nor sentimentality can in any way support the contention that such is a national flag.

The caskets containing the dead recovered from the wreck of the *Maine* were on the occasion of the final obsequies in Washington covered, as the navy regulations require, by jacks. In Havana these same caskets reverently guarded and carried by Cubans were covered with the national flag.

Within a year in the city of Washington have taken place the funerals of two naval veterans, who served under their flag in two wars. Each veteran had reached the grade of rear-admiral. On each occasion the Navy Department recognizing the services rendered by these officers honored their memories by ordering the brigade of midshipmen from Annapolis to form the right of the military escort. The casket of one admiral was draped, as required by regulations, with the union jack. The covering of the casket of the other was the national flag that had been flown during the naval engagement of Santiago by the vessels this officer had commanded on that occasion. The one, a new jack, without service or association, the other a national flag, beloved by both, shell torn and powder smoked, in itself endowed with living attributes of the life to which both veterans had devoted their best hours, days and years. Sentiment, or sentimentality; which draping appeals most to the world, which draping was the one appropriate for the historical dead?

Custom of the service is not without its uses, but such custom when founded on mistaken premises should not exist. The national flag is permitted to be flown over the individual during life time, and offers the protection of the well beloved country; is it not fitting that when taps are sounded for a life ended in the service that the last honors paid should be under the national flag?

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE LE DUC BALLISTIC FORMULÆ.

By G. W. PATTERSON.

The use of these formulæ, in the form given by Professor Alger in the NAVAL INSTITUTE PROCEEDINGS, Vol. 37, No. 2, Whole No. 138, has been limited to pressure calculations, and to fixing charges for low velocities when the charge for a higher velocity in the same gun was known.

As stated by Alger, they failed entirely when used to predict the performance of a powder in one gun from results obtained by firing the same powder in a gun of different caliber. As it was evident that this failure was due to the empirical values given the constants in the formulæ, it was decided to determine these values from actual data on the proving ground.

Starting with the basic formulæ:

$$v = \frac{au}{b+u},$$

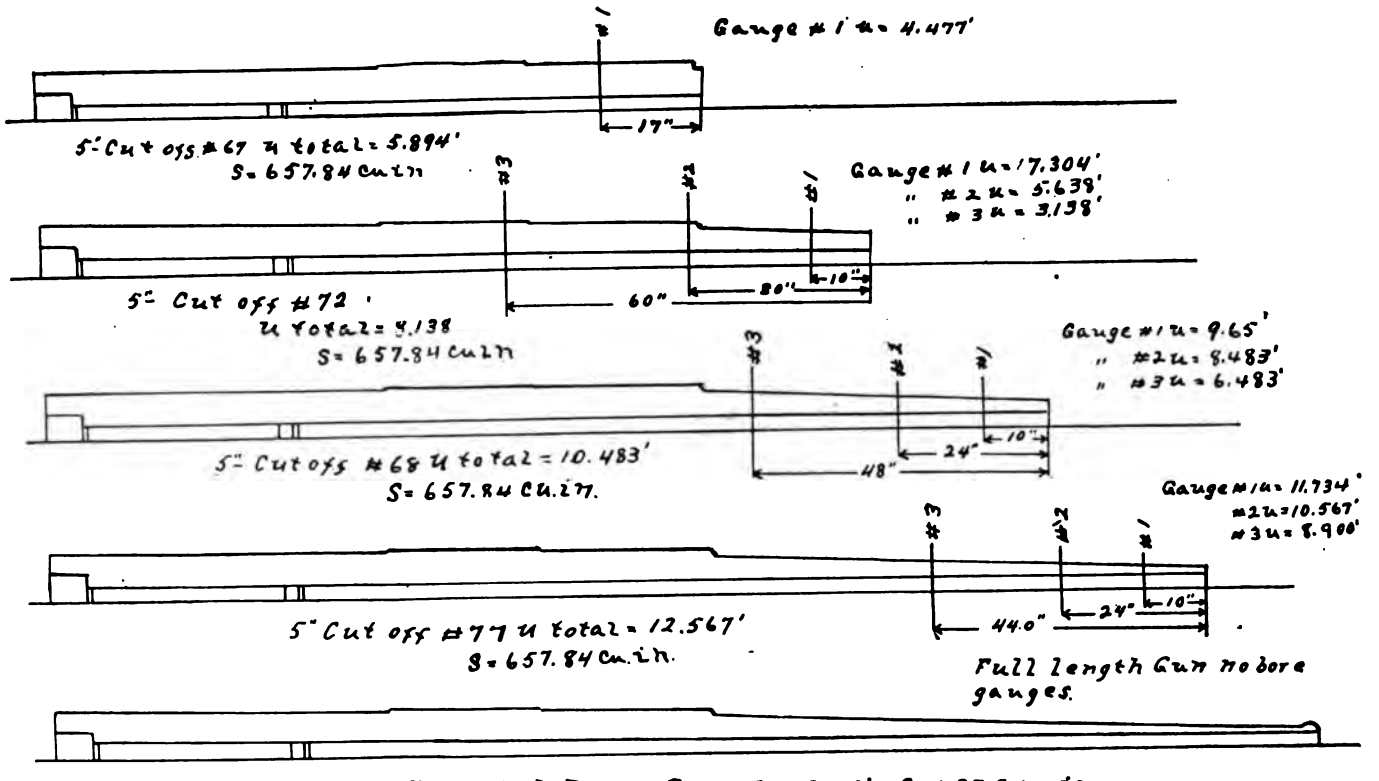
$$a = \alpha \Delta^{\frac{1}{3}} \left(\frac{\varpi}{p}\right)^{\frac{1}{3}},$$

$$b = \beta \left(1 - \frac{\Delta}{\delta}\right) \frac{S^x}{p^y},$$

the values to be determined are those for α, the exponent x or variation due to chamber capacity, and the exponent y or variation due to weight of shell.

EXPERIMENT NO. 1. *Determination of* α.

A series of 5-inch 40-caliber guns was prepared, having the same chamber capacity, but with different lengths of travel of projectile, as shown on Plate 1. Provision was made for inserting pressure gauges at different points along the bore. Using the same powder charge, and the same weight of shell, the results shown on p. 887 were obtained.



J. S. S. Selden

Lieut-Comdr U.S.N. Inspector in Charge

Supersedes No-675

M P & Dwg
700 5-25-12
Scale ½" = 1'

	Charge	Muzzle velocity, f. s.	Maximum pressure, tons
Gun No. 127	8.8	2204	14.27
Gun No. 127	8.8	2204	14.67
Gun No. 127	8.8	2204	14.40
Gun No. 77	8.8	2162	14.16
Gun No. 77	8.8	2162	15.3
Gun No. 77	8.8	2162	13.81
Gun No. 68	8.8	2089	15.16
Gun No. 68	8.8	2089	15.51
Gun No. 68	8.8	2089	15.09
Gun No. 68	8.8	2089	14.88
Gun No. 72	8.8	1969	13.48
Gun No. 72	8.8	1964	13.55
Gun No. 72	8.8	1969	13.74
Gun No. 72	8.8	1969	14.39
Gun No. 67	8.8	1821	14.16
Gun No. 67	8.8	1821	14.11
Gun No. 67	8.8	1821	14.25

The results obtained in bore pressure gauges are plotted on Plate 2. From the basic formulæ we find by elimination:

$$a = \frac{vv'}{\Delta^{\frac{1}{3}}\left(\frac{\varpi}{p}\right)^{\frac{1}{3}}} \cdot \frac{(u-u')}{(v'u-vu')}.$$

From the above results, $a = \begin{cases} 6820 \text{ for No. } 77, \\ 6816 \text{ for No. } 68, \\ 6834 \text{ for No. } 72, \\ 6733 \text{ for No. } 67. \end{cases}$

As little hope had been entertained of obtaining good results with the shortest gun, the fourth result was discarded and the average value 6823 was adopted for use in future work.

EXPERIMENT NO. 2. *Determination of exponent x, variation due to chamber capacity.*

Using a fixed powder charge and the same weight of shell, rounds were fired in the 4-inch 40-Mk. VI and 4-inch 50-Mk. VII guns as follows:

	Charge, lbs.	Muzzle velocity, f. s.	Maximum pressure, tons
4-inch 40-Mk. VI	5.5	2125	13.2
4-inch 40-Mk. VI	5.5	2125	13.34
4-inch 40-Mk. VI	5.5	2125	13.15
4-inch 50-Mk. VII	5.5	1846	6.87
4-inch 50-Mk. VII	5.5	1846	7.07
4-inch 50-Mk. VII	5.5	1846	7.08

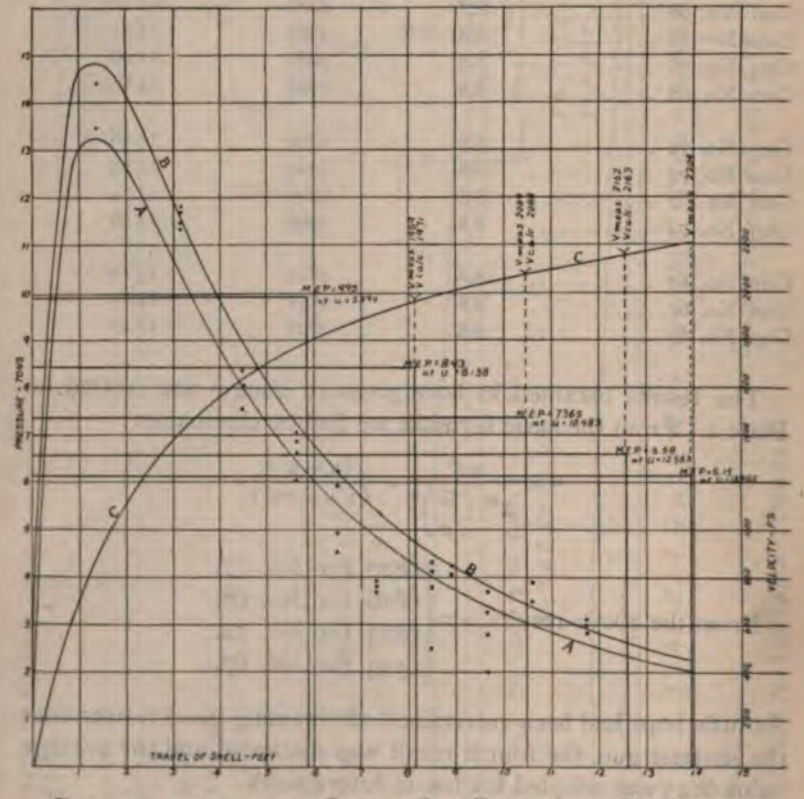


PLATE 2.—5-INCH 40-CAL. CUT-OFF GUN EXPERIMENT. DEC. 8, 1911.

From the basic formulæ we find:

$$\left(\frac{S'}{S}\right)^x = \frac{(a'-v')u'v}{(a-v)uv'} \cdot \frac{(\delta-\Delta)}{(\delta-\Delta')}.$$

From the above results, $x=.674$ and the value used for the formula is $\frac{2}{3}$.

EXPERIMENT NO. 3. *Determination of exponent y or variation due to weight of shell.*

Shell of the same type but of different weights were fired in the 5-inch 50-Mk. VI-1 gun, using a constant powder charge, with results as follows:

Charge, lbs.	Wt. of shells, lbs.	Muzzle veloc., f. s.	Max. pressure, tons
14	50	2437	9.77
14	50	2437	9.77
14	50	2437	9.77
14	50	2437	9.77
14	60	2291	10.61
14	60	2291	10.68
14	60	2291	10.47

From the basic formulæ we find:

$$\left(\frac{p}{p'}\right)^y = \frac{(a'-v')v}{(a-v)v'}.$$

From the above results, $y=.646$ and the value $\frac{2}{3}$ was adopted. With the values found, we have for working formulæ:

$$v = \frac{au}{b+u},$$

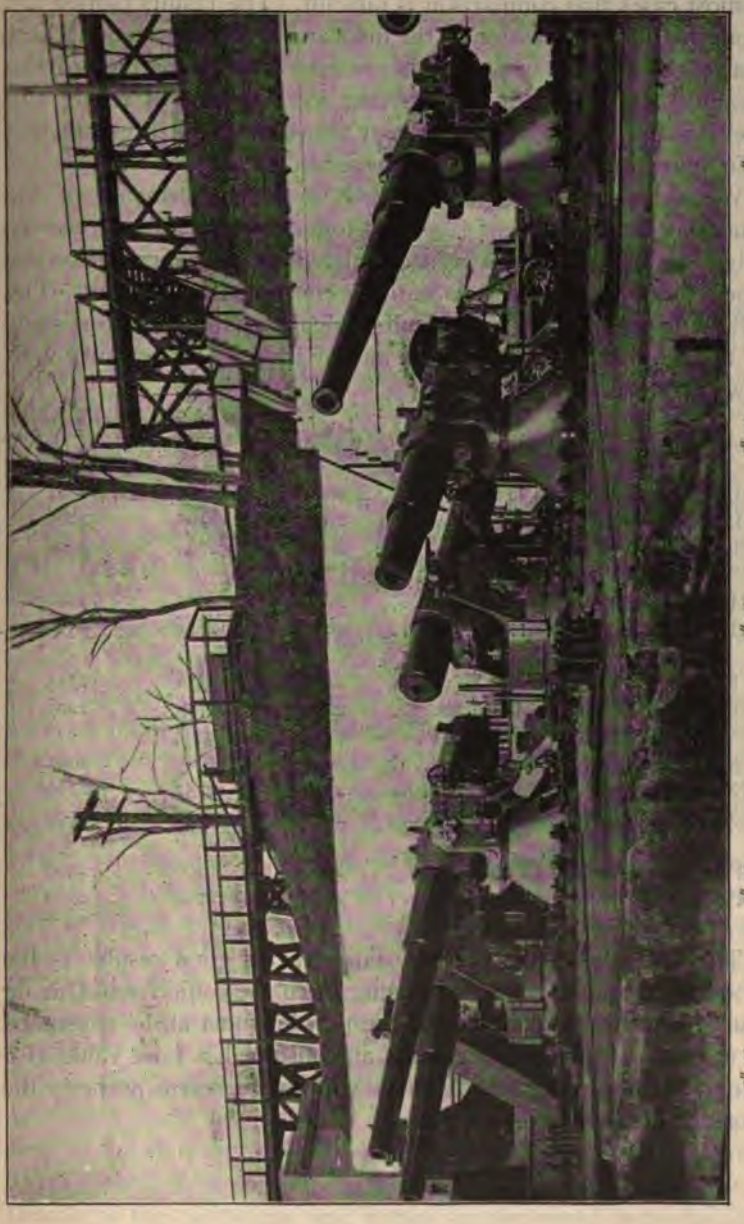
$$a = 6823\Delta^{\frac{1}{2}}\left(\frac{\bar{\omega}}{p}\right)^{\frac{1}{3}},$$

$$b = \beta\left(1-\frac{\Delta}{\delta}\right)\left(\frac{S}{p}\right)^{\frac{1}{3}},$$

$$P = \frac{a^2bpu}{2240gA(b+u)^3},$$

in all of which:

$\bar{\omega}$ = weight of smokeless powder in pounds.
p = weight of projectile in pounds.
Δ = density of loading.
S = chamber capacity in cubic inches.
β = a powder constant.
v = muzzle velocity in f. s.
u = travel of projectile in feet.
A = cross-section of the bore in square inches.
g = acceleration of gravity in f. s.
δ = density of powder. In navy powder this varies practically with the quantity of total volatiles and is shown graphically on Plate 3.
P = effective pressure on base of shell in tons per square inch at any point u in travel of shell.



GUNS USED IN EXPERIMENT NO. 1.

The results obtained by the bore-pressure gauges are so erratic in most cases that comparison is difficult. The results plotted are from the full compression of the discs and it can be stated that this is a fair average of what has always been obtained on the proving ground. In general, it appears that for this type of rifling and shell band a factor of 12 per cent above the shell pressure is a safe figure for calculating gun pressures.

When these formulæ are applied to the performance of the same powder in different guns it is found that they show remarkably close agreement between calculated and measured velocities when the powder charge is entirely consumed in the gun. The following table shows such results, calculations having been made by the original Le Duc formulæ and by the Le Duc formulæ with new constants.

Powder		Gun	Velocity	Velocity calc. from average β	
				Le Duc Old style	Le Duc New Style
IHL	1	6-inch 50 VIII-2.....	2660	2689	2664
IHL	1	6-inch 40 III.....	2203	2161	2205
IHL	1	5-inch 50 V.....	2685	2724	2678
LRFD	2	12-inch Mk. VII	2900	2907	2910
LRFD	2	12-inch Mk. VI	2850	2840	2939
IHPB	12	5-inch 50-Mk. V	2350	2376	2345
IHPB	12	5-inch 40-Mk. III.....	2200	2175	2203
IHX	1	13-inch 35 No. 34.....	2000	1965	2007
IHX	1	7-inch 45-Mk. I	2700	2752	2710
IHX	1	8-inch 45-Mk. VI	2600	2611	2595
ISPB	3	4-inch 50 VII	2500	2406	2499
ISPB	3	3-inch 50 VI.....	2700	2782	2700

The formulæ in the present state give as good results as the modified Sarrau formula. In using them the conditions of firing must be accurately known and the powder must all be consumed in the gun. If the powder is not all consumed, a false value of b is obtained and the pressure curve will not represent properly the work of the powder in the gun.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PREPARATION IN PEACE AND SUCCESS IN WAR.

Translated from the *Marine Rundschau*
By Commodore W. H. Beehler, U. S. Navy.

Our professional literature abounds more and more prominently with details of strategy and tactics. These are important factors, but it is possible to emphasize their importance too much. Our successors must not be taught that every victory is due solely to the superior tactics of the victorious admiral. In every battle—especially where one fleet was practically destroyed—the victorious commander took some steps that must be regarded as theoretically wrong. Such as Nelson's perpendicular attack upon the allied fleet at Trafalgar and Togo's evolution in the face of hostile fire.

As a rule the English understood that the object of studying strategy and tactics was that, the battle is the objective, or that the destruction of the enemy is the object of every measure—without confining themselves too closely to the tactical theories; but the French, though great tacticians, have not so understood it.

At the naval school one learns but little of naval history; this study is first taken up afterwards in the service, but whoever undertakes this study must thoroughly understand that the foundation of all success depends upon the internal efficiency. Herein they will be convinced of the great primary importance of preparation for war. For example, before considering the battles of Nelson's period, a comparison of the efficiency of the navies will demonstrate that a period marked by a Trafalgar was bound to come.

This article proposes to outline the development of the English and French navies at the close of the eighteenth and beginning of the nineteenth centuries, to show that the final destruction of the French fleet was but the logical result of the circumstances. Details of the campaigns and battles are presumed to be familiar to the reader.

THE FRENCH NAVY AT CLOSE OF THE EIGHTEENTH CENTURY.

The Bourbons left France with a navy full of the glorious deeds of a Suffren. Its organization was the product of the genius of Colbert and fully met all requirements. The French naval officers were well selected and efficiently trained, the personnel of seamen and petty officers was then—as it is to-day—excellent and the navy fully justified the highest hopes of the country.

The revolution had its effect on both the army and navy, the older naval officers—suspected aristocrats—were, however, not supported by the revolutionary government in measures to enforce discipline. Soldiers and sailors alike were blinded by political partisanship and great changes were evolved by the confusion. The army revived in a remarkably short time and was fully rejuvenated. The government gave the military leaders full powers to establish an iron discipline and these leaders understood how to inspire officers and men with an enthusiastic zeal bordering on fanaticism such as was signally lacking among the hirelings of the opposing armies. The French army thus had the chief requisite for victory. The new generals of the Republic and their young soldiers broke with the old traditional tactical theories and success justified them in doing so. The allied coalition armies were defeated and the revolutionary contempt for ancient traditions triumphed.

Likewise they attempted to discard the ancient customs and regulations of the navy, but that which proved to be the saving genius of the army was madness for the navy. Unlike the army, the navy was not thereby rejuvenated, but on the contrary it was simply ruined. Consider how much the manual of arms and military parades contribute to discipline and yet may be neglected at times, whereas sail drills and evolutions in seamanship were indispensable and proficiency therein was absolutely necessary for proper use of naval guns in action.

It is incomprehensible how the French could have so misprized seamanship, or how they could have consented to abolish the corps of naval gunners merely because they were suspected aristocrats. But then it was even contemplated to have the French navy resort to the old Roman galleys and the boarding-bridges.

The effect of inadequate supplies operated differently in the army and navy. Bonaparte led his ragged and half famished troops to Italy to victory upon victory and fed and clothed them

in the enemy's country. But it was impossible for Villaret Joyeuse to keep the sea without provisions, with foul and leaky ships whose masts and rigging were rotten and whose sailors had nothing wherewith to protect themselves in the icy December winds nor against the seas and drenching rain. (Expeditions of December, 1799.)

The old navy regulations could not be dispensed with and the French navy thereby lost the efficient corps of officers, its capable administration and the training of its personnel.

The gradually diminishing naval officers of the old French royal navy were replaced by bad, inefficient and numerically inadequate officers. It was difficult to get any officers at all. In 1794, eleven years before the battle of Trafalgar, a French admiral went to sea with 16 captains of ships of the line, of whom three years previously, three had been lieutenants in the Royal navy and the others were sub-lieutenants, merchant ship captains and enlisted men. The admiral himself had only reached the rank of lieutenant at that time. What could be expected of a fleet with such inexperienced commanders or how could they train a corps of officers to be efficient?

The administration of the navy fell into incompetent hands who had not the slightest idea of the needs of the navy. They considered "*elan*" would supply all deficiencies, if not, the admirals were traitors. The most responsible positions were given to visionaries whose only qualifications were that they had good intentions. After one of such officers had left the ministry—Jean Dalbarade—it was discovered that the list of ships of the French navy was so imperfect that orders were issued to fit out this and that ship which had long before been captured by the British.

This new inefficient corps of naval officers never realized their condition. Ignorance goes hand-in-hand with arrogant infatuation. Hoche wrote in 1796: "God preserve me from the navy. All kinds of insubordination and a cultivated lack of discipline prevail in this military organization. Combine ignorance with foolish vanity and you have the picture."

The effect of such an inefficient corps of officers was evident. Good men deserted and were either not replaced at all or were substituted by unwilling conscripts. M. Najac, Ordonnateur de la marine, at Toulon, wrote to the minister in 1798: "*L insub-*

ordination invétérée des gens de mer dans la plupart des quartiers de l'ouest, leur aversion prononcée pour la service, rendent presque nul les efforts des commissaries de l'inscription maritime."

Under such circumstances the French navy carried on the wars of the Republic and Empire. It was not surprising that they could accomplish nothing and that their condition grew worse. The French fleets were blockaded in port and unlearned the little they had acquired, while the British gained experience cruising at sea. Whenever they put to sea and encountered bad weather they returned to port damaged while the leaders and even Napoleon himself believed that the ships were protected and more efficient by staying in port and that the British would be weakened and damaged by keeping the sea. Nelson wrote, March 13, 1805: "Bonaparte has often made his brags, that our fleet would be worn out by keeping the sea, that his was kept in order and increasing by staying in port; but he now finds, I fancy, if Emperors hear the truth, that his fleet suffers more in one night than ours in a year."

Single English ships hovered around and attacked a whole French squadron without suffering any damages while the French only gained few minor successes accidentally.

Fortune in the long run favored the efficient.

THE SPANISH NAVY AT THE CLOSE OF THE EIGHTEENTH CENTURY.

As the Spanish navy was allied with the French after 1796 its condition must also be considered. It suffices to refer to the long series of reverses that the Spanish navy suffered after the destruction of the Armada, to realize its inefficiency. The only good part of the Spanish navy was that which was furnished by their colonies. As the Spaniards had previously been allied with the English the condition of the Spanish navy was well known to the English officers.

THE ALLIED FLEET OF VILLENEUVE.

The destruction of the Franco-Spanish fleet was prepared during the period from after 1793 and was finally accomplished at Trafalgar. Villeneuve's fleet comprised the nucleus of all that carried the French and Spanish flags. The fleet was developed from the eleven ships of the line at Toulon. When Admiral Lat-

ouche Trouville, who was Villeneuve's predecessor, took command, in 1803, he found it deficient in every particular. There was no idea of anything to be done with the fleet. The officers were not even accustomed to sleep on board. (Jurien de la Gravière.)

The energetic and competent Latouche tried his best to improve the navy. He began with drills and short cruises and slight skirmishes with the enemy improved the moralé. In fact everything was progressing finely when all ceased by his sudden death August 2, 1804.

It is not clear how Villeneuve happened to be chosen to succeed him. Napoleon is said to have remarked that he had the best luck—he had escaped from the battle of the Nile. He was, however, a brave man and not incompetent. But the condition of the fleet was enough to make the most efficient commander doubtful. Villeneuve soon broke down under the task. The inefficiency of the fleet was evident to him and the correspondence of this unfortunate admiral gives a graphic view of its miserable condition. He wrote December 19, 1804: *"Les commis aux vivres sont ordinairement des couquins qui embarquent le moins possible et que malheurpeusement la surveillance des officiers n'éclaire pas assez."* Again to Decrès on January 19, 1805, after the first sortie under Villeneuve he wrote: "Our squadron looks fine in the roads of Toulon. The crews are well clothed and drill well, but in bad weather things change, they are not accustomed to bad weather." Bad weather had compelled the squadron to return with damages to port.

With this deficiency in seamanship the artillery training was even worse. Jurien de la Gravière claims that many of the gun captains had never fired a gun before the battle of Trafalgar.

Many of these deficiencies would have been remedied by strict discipline. Surely with strict gunnery drills they could have obtained the same rapidity of gun-fire of which the British navy boasted. But at this period the French did not respect the old navy regulations. A French writer states that instead of sharp vigilance and systematic service they relied on exaggerated self-sacrifices and heroic intrepidity. The Admiral should have exerted pressure upon his captains but these were so deficient that he did not know where to begin.

When the fleet came in to anchor at Ferrol in August, 1805, the ships all collided with each other. Villeneuve then wrote of

his captains: "I believed they would all keep position but none of them seemed able to act with decision."

With such a personnel it is unnecessary to consider any details concerning the matériel of the fleet. A bad, inefficient personnel cannot accomplish anything even with the best matériel.

The prevailing distress in the French ports was one great cause for the deficiencies in the equipment and supplies of the French fleet. Villeneuve's letters are full of complaints. But on the other hand it must be remembered that owing to excessive economy the British were not much better provided. In the French navy there was no Troubridge whose resources equaled the demands of a Culloden.

In this condition Villeneuve's fleet went to sea to fight. Villeneuve wrote: "The lack of seafaring experience of our officers and men and war experience of our captains combined with the great deficiencies in all requirements were such that even a slight disturbance at night threw everybody into confusion."

If the slightest accident at night could cause the admiral such anxiety what would not be dreaded on meeting the enemy? The battle with Calder, who attacked Villeneuve's fleet of 20 French and Spanish ships with but 15 British ships upon his return from the West Indies, July 22, 1805, and captured 2 Spanish ships of the line, gave him a foretaste of what to expect. Villeneuve wrote after this engagement ". . . . we have bad masts, bad sails, bad rigging, bad officers and bad seamen. Sickness prevails among the crews. The enemy is aware of this and ventures to attack with very inferior forces. Our captains have had so little war experience and are so unaccustomed to manœuvers that they only know to follow the leader and thus we are ridiculed by all Europe." Several hundred invalids were landed at Vigo from Villeneuve's fleet upon his return from the West Indies.

At Trafalgar Villeneuve's fleet of 18 ships of the line was reinforced by 15 Spanish ships under the command of Admiral Gravina.

In 1795, when Spain decided to ally with France, Spain agreed in the treaty to provide 14 ships of the line and Nelson wrote: "I assume it to be certain that these ships will not be manned, for otherwise that would be the best way to get rid of them." Villeneuve's letters show that he entertained the same opinion. The ships material was in some respects very good—though much neg-

lected. The worst complaints were in regard to the personnel. The Spanish crews were designated as a "*racaille épouvantable*" by General Beurnonville to Decrès or as "*gens sans feu ni lieu*" by Jurien de la Gravière. Villeneuve said: "It is sad to see such handsome and powerful ships manned by herdsmen and beggar monks." A Spanish officer, who fought in the battle of Trafalgar, described the inefficiency of the crews with all kinds of expressions and the avowal that they were incapable of anything except to compromise the fleet (Escaño). It must be confessed that these crews should have had a better military training and should have been drilled more. It was evident that in all maneuvers they were very slow and they were unable to make even the slightest repairs to the rigging.

Every naval officer will clearly understand the anxiety and worry of the commander-in-chief over the Spanish squadron during the cruise. Villeneuve wrote to Decrès: "*La division espagnole et l'Atlas me faisaient arriver tous les matins de quatre lieues quoique la plupart des vaisseaux fussent la nuit sans voiles.*"

A part of the Spanish division joined the fleet just before the battle of Trafalgar. And as but little could be expected from the Spanish ships that had accompanied Villeneuve on the cruise to the West Indies and return, there was absolutely no dependence to be placed on the new ships. In a council of war before the battle it was established that "*que plusiers de ces vaisseaux n'avaient pu encore exercer leurmonde à la mer, et que les vaisseaux à trois ponts, la Santa Ana, le Rayo, le San yusto, armés avec précipitation etè peine sortis de l'arsenal, pouvaient à la risque appareiller avec l'armèe, mais qu'ils n'etaient point en etat de rendre les services militaires dont ils seraient susceptibles, quand ils seraient complètement organisés.*"

There is still another feature that diminished the value of the Spanish allies. The French fought for their country, while the Spanish fought for the French. They had but little interest in the cause. April 6, 1805 Admiral Salcedo refused to leave Carthegena with his six ships of the line to join Villeneuve. Under such circumstance everybody was inclined to ascribe all errors and accidents to their allies. The fact is reported that Admiral Gravina was the only Spanish naval officer who willingly supported Villeneuve. The engagement with Calder furnishes a good example. The Spaniards blamed the French for the loss of the two ships captured by Calder and claimed that the French

had left these two Spanish ships in the lurch while the French held the Spaniards responsible for their loss. The controversy was so bitter that the intendant of the marine and artillery commandant at Cadiz refused to furnish the French with any provisions or ammunition without cash payment. The difficulty was only overcome through diplomacy. On July 21, 1805, Villeneuve wrote, even before the first engagement: "Would to God that the Spanish ships had not joined this fleet. These ships can only compromise us all."

In the foregoing attempt to explain the condition of Villeneuve's allied French and Spanish fleet and the causes that produced that condition exception will be claimed. It may be said that certain bad features have been deliberately selected and emphasized to show the inefficiency of the allied fleet. But no one can deny that with all these defects there were some good features in that fleet. At Trafalgar both the French and Spanish fought like lions. There was no Nebogatoff in that fleet. They did the best of which they were capable. But this lack of ability is the main point. The inferiority of the allied fleet was due to the lack of ability in the personnel that could not be replaced by any degree of zeal or bravery. It must be conceded that the average man in each fleet was equally brave and fought with equal courage since the average man is not a coward. There are, indeed, certain national virtues and vices that have a tendency to make a people apt to qualify as seamen but skill is the great requisite for efficiency in sea battle. The lack of skill in the personnel of Villeneuve's fleet was so great that nothing could be expected from it. Here and there individuals did prove efficient but the average decides, and the average skill in Villeneuve's fleet was so inferior that the greatest strategical genius and cleverest tactics were unavailing. It is not surprising that such a debauched fleet should have earned defeat, the wonder is that they were not sooner destroyed. Why was it necessary for a Nelson to appear? This can be answered by considering the condition of the British navy at this period.

THE BRITISH NAVY AT THE BEGINNING OF THE NINETEENTH CENTURY.

While Mahan, in "*The Influence of Sea Power upon History*," describes the condition of the French navy after 1793 more fully than possible in this brief sketch, he gives very few details about

the British navy. He briefly mentions deficiencies without laying sufficient stress upon the importance of these deficiencies and their effect upon the results.

The requirement to be always prepared for war, even when there was no urgent necessity apparent, is a much more recent policy of England. At all events they had not reached this standard in 1793 any more than in the war of American Independence, in 1773, nor in the American war of 1812. Preparedness for war requires that a strong fleet shall be kept constantly in commission. The strong plutocratic element in the British parliament found it difficult to provide the necessary appropriations for the navy, and the few ships that were kept in commission were so inadequately provided that subsequently they were obliged to expend twice as much in war.

The naval administration was corrupt. In 1801 Sir John Jervis designated the civil branch of the navy as an "*Augean Stable.*" Corruption and neglect prevailed among the contractors and prize agents. Marryat's novels, though works of fiction, give a clear idea of the almost inconceivable corruption that prevailed in many British ships. The worst feature was that of the personnel. The sailor led a dog's life on board ship. With the greatest care it was difficult to get bare necessities and when, as frequently happened, the captains neglected their duty the conditions were unbearable. Brutality prevailed instead of strict discipline and immorality instead of virtuous examples. Very few volunteers would risk service in the British navy with brutal captains. They were obliged to resort to the press gang and men were given a choice to serve in the navy or go to prison. The character of a rabble recruited by such means can be imagined. In 1796 Collingwood wrote: "I have on board a motley crew from all countries: Germans, Austrians, Poles, Croatians and Hungarians." But certainly even such a personnel could be trained under proper leadership to accomplish something but the proper leadership was not always available, and, therefore, they had the great mutiny of 1797, when a sailor leader of the mutineers commanded the Thames and paralyzed the commerce of London. This experience was the fault of the bad element in the corps of officers. In their efforts to economize much had been overlooked.

These conditions clearly explain why the British navy in the wars with the republic were not as successful as might have been expected from the very first. Nothing can be accomplished with

bad interior economy. The inferior officers will only reveal their inferiority in battle. On the glorious first of June many of the British captains were notoriously incompetent.

But there is no doubt that the nucleus of the British naval officers was efficient. This nucleus fully recognized their own deficiencies and labored to correct them. The wars displaced the inferior officers and produced good men from before the mast, among whom we find Admiral Jervis. Jervis was not the only reorganizer but he was the best and most successful. His work is mentioned as an example how to build up and develop an efficient navy, especially since the officers and men trained by Jervis formed the nucleus of the victorious fleet at Trafalgar.

Sir John Jervis relieved Hyde Parker in command of the Mediterranean fleet November 30, 1795. He had previously distinguished himself in battle but was better known for the manner in which he commanded his ship, for his iron discipline and thorough efficiency on board his ship.

Upon taking command of the squadron he introduced his system on board the ships of the fleet. He began by thoroughness in small details as with the much neglected uniform regulations. We now know how he beguiled the long uneventful period before the battle of St. Vincent. Jervis began his work by strong pressure upon his captains. He placed an entire staff under arrest whenever he had any occasion to be dissatisfied. He required his captains to exercise as much care for the welfare of their crews as he had done when he was a captain. In case of any lack of discipline the captain would not be permitted to sleep ashore. We recall that when Latouche Trouville took command of the French fleet at Toulon none of the officers were accustomed to sleep on board. The discipline of the officers insured the discipline of the men.

Jervis himself personnally developed this discipline by requiring the most painstaking and thorough clothing inspections indicating that nothing was beneath his notice. He rewarded personal service, the family claims of those who had lost a father or brother in the service, and the very friendlessness of a dutiful man received his best patronage.

A crew that is being trained to the highest proficiency will be properly handled and they must learn something. Jervis found much to do. He it was who introduced ventilated hospitals on

the gun deck. Also the regular routine of airing bedding that he required should be entered in the ship's log. The beneficent effect of these measures is illustrated by a comparison of the health of the British with that of the French crews.

In caring for his men he kept them busy. His hobby was the exercise of great guns and practical seamanship. He designated everything else as "frippery and gimcrack." He required daily gun drills. Consequently on the best British ships: *Foudroyant, Dreadnought,* etc., they fired one shot per gun per minute, while the French could only fire one shot per gun once every three minutes.

Jervis is described as a pedant. It is said that he always required every officer and man to salute him with raised hat and always to appear at flag parade in full uniform. But are not military forms the greatest aids for discipline? And was not the British admiral right in disciplining the British navy through little details? All these apparent trifles had an ennobling effect when used for such an objective rather than merely to gratify the personal vanity of an individual.

Jervis succeeded. He was rewarded by the honors that Nelson received through this Mediterranean fleet; since Nelson recognized his work. The majority of the captains must have felt as Nelson did, otherwise they would not have formed such a band of brothers.

The work of a preparer is not agreeable and he is subject to sharp criticism. St. Vincent's method of training were not English and even Mahan fails to give the old iron lord full credit for his work. The acute opposition he stirred up deceived the ear of his contemporaries and it was left for the future to properly estimate its value. Jervis was like Friedrich Wilhelm the First whose great work of preparation in peace has only recently been recognized as having made the great deeds of Frederick the Great possible. Genius requires the work of the ordinary man and spurs him on to faithfully perform his simple task with average ability without other consideration.

After the battle of the Nile, Nelson wrote to St. Vincent: "We owe you the victory at Aboukir." This was not a mere compliment but a recognition of the truth that does not belittle but enhances Nelson's genius. In the last analysis the British owe their victories at Aboukir and Trafalgar to the superior ability and this

superior ability was due to their organization that Admiral Jervis had introduced.

Before this reorganization had been introduced the results of the battles could only be meagre notwithstanding the inferiority of the French fleets. Compare Lord Howe's fleet on June 1, 1794, with that of Jervis' at St. Vincent, in 1797. On the former neither signals nor maneuvers functioned as they should and the conduct of some of the captains was questionable—such as that of the leading ship *Ceaser*. In the latter, signals were not necessary because the leader knew the admiral's plans and the modest commander only had the highest praise for the closed formation that had been maintained during the previous night. On June 1 a better trained fleet than that of Lord Howe would have destroyed the numerically equal French fleet that was in no respect one whit better than the allied fleet at Trafalgar. Jervis attacked 27 French and Spanish ships with but 15 British ships at St. Vincent, but the political situation operated to prevent Jervis from using all his forces to make that victory more decisive.

But, besides, it was necessary for the British to have time in which to learn of the inferiority of the French fleet. The uncertainty of what the enemy might be able to do is often liable to cripple the decisions of a commander. A Nelson could naturally perceive this inferiority quicker than any other, and this perception encouraged him to operate as he did at Aboukir and Trafalgar. Nelson despised the enemy and relied upon his superior efficiency and the results justified him. The message Nelson sent to St. Vincent after the battle of the Nile proves that he recognized the true cause of the superior efficiency of the British fleet.

NELSON'S FLEET.

Nelson depended upon the work of his predecessor though he was far inferior in genius. It is difficult for many to recognize this fact but "the appearance of a prodigy like Nelson is not an isolated event, independent of antecedents. It is the result of a happy meeting of genius and opportunity. The hour has come and the man. Other men labored and the hero enters into their labors."

It was natural that officers and men almost deified Nelson while they despised Jervis. The pressure of the superiors was not as

heavy with the former as with the latter. They did not need it because the new order that had been prepared by Jervis was in full operation. Thus Nelson could take another step in training his officers. He taught his captains to think as he did and succeeded so well that at Aboukir every captain distinguished himself, something which had never been known before that battle of the Nile. It is interesting to note that Nelson did not oppose St. Vincent's ideas and was not a stranger to his system. He was not one who merely impetuously fell upon his foe as many superficial readers claim. He who thoroughly studies the character of the great admiral will perceive that he thoroughly went into every detail of internal management and discipline as he had been taught by Jervis.

Nelson's painstaking, accurate personal observations of the barometer and his precautionary orders for stormy weather elicited the astonishment of a French writer . . . . "*le bouillant amiral ménageait ses vergues et ses voiles dans les circonstances ordinaires plus soigneusement, que son vaisseau ou son escadre dans les occasions decisives.*" But as stated it was not so in the French fleet. Perfection in internal management and discipline cannot be obtained without a certain amount of pedantic thoroughness. But it was exactly the perfection of internal management of the British ships that justified Nelson in decisive moments to be bold and impetuous.

We find that Nelson followed in Jervis' footsteps. Mahan states that Howe, "the sailor's friend," did not provide for his people any better than Jervis did. Nelson did likewise. Nelson even justified the claims of the mutineers of 1797.

Nelson concerned himself personally in regard to the subsistence of his crews. The grand admiral did not think it beneath him to investigate the tests to which dried prunes and fresh and salted fish were subjected before being issued to the men.

We recall the words of Frederick the Great: "A soldier fights as he is fed." The private man must be conscious that his superior officers are concerned about his welfare. Work for the men must accompany working with men. Without both neither French —"*elan*"—nor British tenacity will avail.

The foregoing suffices to illustrate the condition of Nelson's fleet. Indeed, nothing was perfect and the British made many mistakes, but the average was capable and they knew their own

efficiency as well as the incapability of the enemy. These conditions made them energetic and inspired them with a determination to win so that every British captain, officer and man was most anxious to "board the enemy." The fruit of Trafalgar was ripe.

It is only when the underlying reasons are clearly explained that we can understand why the destruction of the allied French and Spanish sea power was bound to come. On the one hand we have superior leadership and a far greater efficiency in the fleet while on the other hand an inferior leadership with a complete lack of efficiency.

History shows that occasionally a brilliant leader may accomplish something with a defective personnel but it is only temporary and will not last. Whereas, thorough training is much more likely to repair the errors of a leader; besides the navy which is efficient is much more likely to produce the man for the hour.

The foundations for success in war must be laid in daily service at sea in peace. The young officers serving at sea should be impressed with the importance of these facts. It is often difficult to appreciate the value of the endless drudgery of the daily routine.

There are many embryo Nelsons who even as young lieutenants are much more concerned with strategical studies than in clothing inspections but this does no harm. This article is not intended to depreciate those studies because there is much in common in the tactics of the old sailing ships with modern tactics. We can, however, emphasize the fact that our work in the navy to-day is very similar to that peace preparation for war of the old times and which laid the foundation for success in the wars. The ideal joy in the service is emphasized for the young officers when they clearly realize its importance from their historical studies.

(Signed) GERCKE.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

HOW TO MAKE A NAVAL APPROPRIATION.

By PAY DIRECTOR LIVINGSTON HUNT, U. S. Navy.

To the average naval officer the subject of naval appropriations does not strongly appeal. He dreads the array of figures, the strange technicalities of bookkeeping, the numberless presentations of a single item, the apparent confusion of debits with credits; yet, even to him, I believe there would come an hour or two of interest in dry statistics, if he were to have the opportunity to examine the British estimates of naval appropriations for the year 1912-13, and would proceed to compare them with his own.

In the first place it will interest him to find himself studying the appropriations of a foreign country in a language which makes him feel as if the subject-matter in hand were intended to be written for his own country. At once the method of handling the subject is brought within his easy comprehension, and his attention is aroused by the way a foreigner treats a matter which is of vital importance to him. He cannot fail to begin thinking, comparing and analyzing. With a navy about two and half times the size of our own and with an annual expenditure about 75% greater; with an experience that is larger and longer than our own, and with a conservatism that is averse to mere experiment, he will feel that he cannot afford to condemn, without examination, the methods employed by the English in appropriating money for running so colossal an establishment as their navy. First of all he will be enlightened by ascertaining that the estimated grand total of naval expenditure for the fiscal year in Great Britain amounts in round numbers to $225,000,000, and in the United States to about $125,000,000, or $100,000,000 less than in Great Britain. These big numbers are impressive and we naturally proceed to inquire into their components, that is, to find out how many divisions of expenditure are included in the acts of legislation which authorize such huge appropriations. The English

method of legislation for an appropriation is simple in the extreme. Only fifteen headings dispose of it all. Fifteen grand divisions of naval expenditure, and no more, are all that are voted by the British Parliament annually. Here they are for the current fiscal year:

II. EFFECTIVE SERVICES, 1912-13.

1. Wages, etc., of officers, seamen and boys, coast guard and royal marines	£7,801,500
2. Victualling and clothing for the navy	3,359,437
3. Medical establishments and services	289,965
4. Martial law	3,600
5. Educational services	218,885
6. Scientific services	103,789
7. Royal Naval Reserves	436,432
8. Shipbuilding, repairs, maintenance, etc.	
Section I. Personnel	3,515,800
Section II. Material	5,457,100
Section III. Contract work	13,230,600
9. Naval armaments	4,064,700
10. Works, buildings, and repairs at home and abroad	3,547,000
11. Miscellaneous effective services	545,386
12. Admiralty office	437,350
Total Effective Services	43,011,544

III. NON-EFFECTIVE SERVICES.

13. Half pay and retired pay	977,212
14. Naval and marine pensions, gratuities, etc.	1,547,126
15. Civil superannuation, compensation allowances, and gratuities	413,410
Total Non-Effective Services	2,937,748
Grand Total	£45,949,292

Now let us look at our own list of estimated appropriations for the same period as shown in the honorable secretary's report last December. I would like to insert all these estimated appropriations in this article, but to do so would make the article appear like a side-note to the estimates. It takes about twenty pages of the secretary's report to enumerate them. No less than two hundred and forty-odd items, or separate appropriations—all to be embodied in the law—are requested for the fiscal year. Not everything imaginable for navy purposes is estimated for, but a pretty fair start in that direction is made. For instance, under

the Bureau of Navigation we find separate and individual appropriations requested for the following purposes:

Transportation.
Recruiting.
Contingent.
Gunnery exercises.
Steaming exercises.
Experiments in aviation.
Outfits on first enlistment.
Maintenance of naval auxiliaries.
Naval training station, Colorado.
Naval training station, Rhode Island.
Naval training station, Great Lakes.
Naval War College, Rhode Island—maintenance.
Services of a lecturer on International Law.
Services of civilian lecturers.
Care and preservation of library, etc.

These are a few of the 240-odd estimated appropriations to be legislated for. There are separate and distinct appropriations ranging from the sum of $100 for traveling expenses for collection of records, up to very large sums. Continuing our comparison and selecting one of the most striking differences in the two papers before us, we find that our British friends appropriate funds for "Works, buildings and repairs at home and abroad" under one single heading, whereas we cannot accomplish the same end without employing less than one hundred and fifteen separate appropriations under the general subject of "Public works." One to one hundred and fifteen! How do they do it? Why do they do it? Let us see. In the first place it is only common sense, from the point of view of the accountant, to combine and classify the great general purposes of the naval establishment under a few heads of expenditure. This indicates in financial language the doings of the navy and the measure of its achievement of its purpose. A few, and only a few, great ledgers of bookkeeping are the natural corollary of this general scheme. In the opinion of the present writer, simplicity of bookkeeping alone would justify a small number of large appropriations in providing for a navy. In charging up expenditures for the many items and services pertaining to our own navy, we are forced to search among two hundred and forty-four appropriations or ledger accounts for

the current fiscal year, and about as many more for the previous fiscal year, in order to locate our charges properly. A small number of appropriation accounts grouped according to similarity of purpose would seem to be sufficient. Herein lies the secret of the merit of the English system; it first grants large lump sums and then exacts minute and numerous accounts of their use. The British annual appropriation with its short list of money grants is based on an annual publication called the "Appropriation Account," which the British government prints, and which rigidly accounts, in thousands of items, for every cent which has been expended for the navy during the previous year. With us the attempt is made to appropriate separately for each small item of account. With the British the multiplied account comes after the granting of the big sum, not before; and each little account is not inserted in the language of the appropriation act.

After the bookkeeping, the most noticeable advantage of the British method of appropriating money is its economy. There is no doubt that with us it is also a belief in economy, and not a regard for bookkeeping, which makes our government insist upon enacting into law a multiplicity of appropriations with a specifically stated sum of money for each one. For instance, it knows that to limit the outlay for an ammunition store-house to $1000 is to prevent the Navy Department from spending one dollar more upon it. Nevertheless, if, with the most careful attention, the store-house cannot get roofed in for the sum mentioned, the Department must, perforce, request the immediate passage by Congress of an Urgent Deficiency Act before it can go ahead and complete the roof. It is apparently considered by our government to be unwise or extravagant to allow a cabinet minister the privilege of applying to the unfinished roof any funds which may be in excess of the needs of some other item of appropriation. Yet economy is not attained, for either the building just described must stand unfinished, and thereby deteriorate, or else a Deficiency Act must be rushed through Congress. Simpler and equally economical in expenditure, and more economical in time, effort and management of business, would be to give the Secretary of the Navy the right to apply a surplus of one item of appropriation to a deficiency in another.

The inclusion under one big appropriation of many small kindred objects, without actually naming them, naturally sug-

gests the right of the administrative power to so allot the big appropriation among the many small items as to permit the transfer of an excess in one allotment to a shortage in another. In this right to employ an excess in one place to wipe out a deficiency in another we would be spared much or all of the extra deficiency legislation which we must ask for every year. This right, as a matter of fact, is exercised by the British Admiralty, not only between the many small unnamed items that are covered by each grand appropriation, but also between the fifteen grand appropriations themselves.

The incentive to economy in expenditure is always present with every Secretary of the Navy and every administration, because every Secretary of the Navy likes to compare favorably in this respect with his predecessor. Under our present system he has every year to offset an attractive statement of surpluses, which he has managed to save out of certain appropriations, by a list of deficiencies in others which unforeseen exigencies compelled him reluctantly to incur. It is instructive to note that the Deficiency Act for the year 1911 and for previous years carried a total of $547,762, whereas the surplus balances left from appropriations for that year and for previous years amounted to $3,702,556.33. The writer has not separated the appropriations for the various years in the above figures, but he is certain that the Deficiency Act for 1911 would have embraced a very small sum, or would have been non-existent, had the Navy Department possessed the right to apply a surplus to a deficiency. Since 1900 there have been naval deficiency acts passed to the amount of over $55,000,000. This large amount of money was absolutely necessary to carry on the navy, notwithstanding the caution of our legislators to provide an exact limit to the several hundred small items which they had embodied every year in the naval appropriation acts. There has always been, and there always must be, a long list of annual deficiencies under our present system of making appropriations. But it will not be easy to change the present system, for the aversion of Congress to granting "lump sums" is proverbial. We must deal with this aversion and prove that to appropriate a large sum of money for one general purpose, such as, for instance, for "new batteries for ships," is not to lose control of the economical expenditure of every cent of the large appropriation any more than if each of the separate small ob-

jects to which the large fund applies had been appropriated for by special legislation. This complete control can be obtained by Congress by the simple process of following the British plan of exacting from the spenders of the appropriation an exact accounting of every cent expended.

As a result of his study of the matter of navy appropriations, the writer suggests the following scheme of items for a naval appropriation act, knowing it to be imperfect but believing it to be worthy of examination by others, to the end that a body of thought and opinion on this important matter may be formed and may in time effect a desire to change from our present troublesome and antiquated system. The scheme suggested is experimental and perhaps some of the subjects under one heading may more properly be included under another:

AN ACT making appropriations for the naval service for the fiscal year .....

Be it enacted, etc.—That the following sums be and are hereby appropriated for the naval service for the year ending .....

FLEET EXPENSE.

1. Pay and allowances of officers and enlisted men..... $.....
2. Fleet expense at yards and stations—
   (a) Labor and material for repairs, outfitting and manufacturing for fleet..... $.....
   (b) Purchase of supplies of all kinds (except provisions and clothing) ..... $.....
   Total..... $.....
3. Provisions and clothing..... $.....
4. Miscellaneous fleet expense (colliers, fleet running expenses, emergencies, miscellaneous)..... $.....
5. Increase of Navy—
   (a) Ships ..... $.....
   (b) Armor and armament ..... $.....
   Total..... $.....

SHORE EXPENSE.

6. Maintenance of yards and stations..... $.....
7. Miscellaneous shore expense (hydrographic office, Naval militia, purchasing offices, miscellaneous.....
8. Hospitals and medical department ..... $.....
9. Navy Department ..... $.....
10. Naval Academy ..... $.....

11. Marine Corps ..... $.....

LIEUT.-COMMANDER W. B. CUSHING, U. S. NAVY.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WILLIAM BARKER CUSHING.

(CONCLUDED.)

By CHARLES W. STEWART.

THE VIRGINIUS AFFAIR.*

The "*Virginius* Affair" gave Cushing an opportunity to show his energy and intuition. Upon learning that the crew of the *Virginius* were being summarily executed he hastened without orders from Aspinwall in command of the U. S. S. *Wyoming* to Santiago de Cuba and promptly called upon the Spanish General Burriel, and it is worthy of note that no prisoners were executed after Cushing's arrival.

The official story of Cushing and his forcible and successful protests against further executions of *Virginius* prisoners is told in the House Report herewith and in Rear-Admiral Chadwick's "Relations of the United States and Spain: Diplomacy." The true detailed story has probably not appeared in any connected form.

The *Wyoming* arrived at Aspinwall September 23, 1873, under orders to remain there until relieved. Her crew was held in readiness to land and keep open transit over the Panama Railway. Continuous drills for "Arm and Away Boats" were maintained. The Royal Mail steamer *Severn,* aground at Manzanillo Point, was gotten afloat October 3. Target practice with the heavy battery of 2 XI-inch, 4 IX-inch and two or three smaller guns gave audible evidence in Aspinwall harbor that the *Wyoming* was able to enforce her commander's wishes. The American steamer *General Sherman,* for participation in some degree in the rebellion in Panama, was seized by Cushing, and his officers and men put in possession. This seizure was later upheld by the United States courts, and the *General Sherman* was condemned at Key West

* Voluminous correspondence and testimony relating to the steamer *Virginius* is in Diplomatic Correspondence and in Executive Document No. 30, 43d Congress, 1st Session. The *Virginius* carried a crew of 52 and 103 passengers. Four passengers were executed November 4, twelve passengers were executed November 8, thirty-seven of the crew were executed November 13, 1873. One hundred and two of the survivors (fifteen of the crew and eighty-seven passengers) were received on the *Juniata* December 18 and landed at New York, December 29, 1873.

and sold by the government. All this gave Cushing some good practice in international law. When he heard on November 8, by cable from Mr. Nunes, U. S. Consul at Kingston, that protection was needed at Santiago, Cushing demanded more facts and learning the truth cabled to Mr. Nunes, Nov. 10, "Am now coaling; will leave to-night or early to-morrow morning for Santiago." The *Wyoming* sailed at daylight, November 11, and, stopping on 15th at Kingston for information and a pilot, arrived off Santiago that night and anchored in Santiago at 11 a. m. the 16th. A letter was sent at once to the general in command at Santiago. The *Virginius* had been taken from Santiago before Cushing's arrival. At the interview between the governor and Cushing accompanied by Lieutenant Hutchins, U. S. Navy, it is said that General Burriel advanced to meet Cushing with hand extended; the more Burriel advanced his hand the more Cushing drew his own hand behind his back. Cushing never took his eyes off Burriel. The governor grew nervous for he had met his master. There was no loud talk. The governor was constantly shaking his right leg, and looking furtively away. He did not like Cushing's stare. It was at this time that Cushing advised Burriel "If he intended to shoot another one of the *Virginius'* prisoners he would better first have the women and children removed from Santiago." Burriel promised not to shoot any more prisoners and further that he would retain the prisoners at Santiago. It is said that Burriel left Santiago that day and the lieutenant governor took his place. The United States later demanded that Burriel be punished, but he was promoted in rank and died in 1877 a major-general.

Cushing's scheme to retake the prisoners was as follows: Cushing was to lay the *Wyoming* to command the main street. One party was to land at night and surround the governor's palace, thus cutting off all communication. Another party was to land and, with a spare topgallant mast for a battering ram, take the jail where the *Virginius'* prisoners were confined and after releasing and arming them, all hands to the ship. Each man was to wear a broad white band on his left sleeve. If this plan had been carried out it is possible that "Cuba Libre" would date from 1874. Cushing was senior to Dewey, Schley and Sampson. If he had commanded the North Atlantic Station in the Spanish-American War one may imagine with what glee he would have visited Santiago de Cuba and attacked the Spanish squadron under Cervera.

This story is told by one of Cushing's officers:

I was on the Asiatic Station when Cushing was there and saw a good deal of him, and I was his navigator on the *Wyoming*. Admiral Emory was with Cushing on the *Maumee* in the east; that was an interesting cruise made by Cushing. We were in the habit of calling him "Albemarle Cushing." Rowan, later vice-admiral, reported that the *Albemarle* had paralyzed our fleet in the sounds. Cushing sunk her with a torpedo boat of his own design—best in those days—crude in this.

Of course, Cushing had his enemies; some from fancied ill-treatment, others from failure to understand his character, and last, but not least, enemies who were jealous of his success. He was the only junior officer that has ever received the thanks of Congress. Cushing was the soul of honor and abstemious to a marked degree, at all times. Nothing would give me more pleasure than to reply to any of his critics during the time that I knew him. Cushing never had the opportunity to acquire a knowledge of navigation or seamanship, but during the Civil War he always had his fighting tacks aboard, and I have heard it from word of mouth about many of his exploits, which he was loath to talk about, but would be brought out by a simple question during our night watches, as well as by day, he captain, I navigator. He had the greatest confidence in those whom he thought loyal to him. He never laid or changed a course in all the time I was navigator with him on the *Wyoming*.

I was with him, his aid, when he called upon General Burriel "The Butcher," an impressive meeting at Santiago de Cuba. He told me that he would retake the *Virginius* and promised me command of that vessel. The Spanish authorities got her out of the harbor a day or two before we arrived, to Cushing's disappointment. Burriel left town the next day after Cushing called upon him. I heard Cushing tell him if he intended to shoot another one of the *Virginius* prisoners, he must first have all the women and children removed from the city of Santiago de Cuba, for he would certainly take the place. It was a grand sight when he stood up and looked "The Butcher" down. Commander Braine was sent down to Santiago de Cuba to investigate the *Virginius* affair; the investigating had already been done by Cushing. It was at this time that Secretary Robeson sent the celebrated despatch to Braine at the New York Navy Yard—"For God's sake hurry on to Santiago de Cuba. We are afraid that Cushing will do something." Well might the Department be alarmed, for Cushing had sailed from Colon without orders, having come there with orders to remain. Cushing was intensely patriotic. Through the cable from Kingston, Jamaica, he heard of the murder of his countrymen, and he immediately coaled ship and sailed. At Santiago one day, after the arrival of the *Juniata*, some of the officers had been crowded off the street by soldiers in uniform on duty, and our officers in uniform; he remarked he would be d—d, if he would stay there; that the authorities had also lied to him. We left leaving the *Juniata* there.

A good many pages could be written about the happenings at Santiago de Cuba during those times, for Cushing was at his best. Upon the return of Cushing and myself from the call upon Burriel, Cushing went on

board the *Niobe,* Sir Lambton Lorraine's ship. This meeting was very interesting, for they were both fighters down to the deck.

Cushing predicted what happened years after his death, the downfall of Spanish dominion in the West Indies. The death-knell, Cushing said, sounded when the order was given to the firing squads at Santiago to "Fire," and poor Ryan, Fry and others fell, shot down like cattle standing facing a slaughter-house wall on the outskirts of the city. Cushing, I, and others saw the spot where their bodies were thrown into a common grave. All this was so crushing to Cushing's feelings, I wondered at the time how he held himself in check and thus avoided bringing on a war. Of course, had he done so, he might have been sacrificed, though I believe that public opinion would have been with him; for *the public has always been good to the Navy, when the Navy was on the fight to redress a wrong.* Cushing did not know when at Santiago de Cuba that mass meetings were being held in New York City to protest against the Spanish outrages. Had he known this I feel assured that he would have taken the *Tornado* and gun-boats then in the harbor and captured the city. It was not known at this time that Cushing was in communication with the Cuban patriots just outside the city of Santiago, who were ready to come in should he make an attack—not that he made any compact with them—he was too honorable—but they communicated their intentions. Whether he replied I do not know.

I was with Cushing the last day that he was on duty. He was the senior aid and I was the junior aid to the commandant of the navy yard at Washington. Mrs. Cushing was very much worried about him, and on his last day asked me to get him to come home. I did not realize how sick a man he was.

He was a devoted husband and father. He loved his wife to adoration. Who was it said "—The bravest are the tenderest, the loving are the daring"? I never knew a man so considerate of other people's feelings.

Another officer has written:

The *Wyoming* was stationed at Colon on account of a revolution going on in Panama, with orders from Rear-Admiral Scott, commander in chief of the North Atlantic Squadron, to remain there until further orders. We had been there some time when the *Virginius* affair took place. Our first knowledge of the seizure of the *Virginius* was by a telegram from the American Consul at Kingston, Jamaica. Cushing decided to coal immediately and leave for Santiago, via Kingston, as the occasion demanded prompt action and he could not waste time in communicating with the Department and waiting for an answer. On arriving at Kingston, we filled up with coal, took a pilot who knew Santiago, and steamed with utmost despatch to Santiago. On our trip from Colon to Kingston we had made the best speed that we could with the weak boilers we had in the ship. We were in ignorance of what sort of a reception we would have on arrival and thought the Spanish authorities might try to keep us out; but I know that Cushing intended to force an entrance into the harbor even if it was necessary to bombard the entrance forts. The battery was loaded, men at quarters for action and everything ready in case of trouble. The Cuban

pilot was told if he played any tricks he would be shot. On our arrival at anchorage off the city, the English man-of-war *Niobe* was there. She had been there two days. Cushing found that the English captain had not been able to get any satisfaction from the governor and was being put off with the usual Spanish tactics, with all sorts of excuses and delays. On Cushing asking for an audience with the governor the same method was used. Cushing then sent word to the governor that if he did not see him by a certain date, and if any more prisoners were executed, as they threatened to do, he would open fire on the governor's palace. This brought things to a crisis, and a time was appointed for his reception. We gave the authorities evidence that we meant business the first night of our stay in the harbor, by spiking chain cable on outside of hull opposite engines and boilers, cleared ship for action, rigged boarding nettings at night with a full watch on, and kept our pivot guns trained on vessels nearest us. In all verbal communications I think Cushing took the lead, and I think most of the demands originated with him. The demands made were that no more prisoners should be executed and that both commanding officers should be allowed to see all the prisoners remaining. There were no more executions. During our stay, until Braine came down in the *Juniata,* we had not a single word from outside of Santiago, and we did not know if war had been declared or what arrangements the government was making. A French gun-boat came in and her commanding officer could not get any satisfaction from the Governor. I believe he did not even see him. The Frenchman came on board to consult Cushing and told him his troubles. He asked Cushing what he must do. Cushing replied "Bombard the palace or go back to Martinique." The Frenchman's reply was "I will let you do the bombarding, and I will return to Martinique," which he did. The American vice-consul kept us informed of everything that was going on, even in the palace. Plans were made to release and bring on board the prisoners at night, as the prison was not far from the landing, and I think there would have been an attempt made if Braine had not arrived. I think also the Spaniards had an idea that something like that might be done as they kept a strong patrol along the sea-front. Of course the arrival of the *Juniata* and *Kansas* took the case out of Cushing's hands, as Braine was his senior, but by that time things had been pretty well settled and the Spanish authorities forcibly impressed by Cushing. One day Cushing was informed by the vice-consul that there had been a council held by the governor and naval officers to see how prisoners could be gotten away from Santiago. The naval officers had a wholesome horror of Cushing, and only one offered to do it, but only in case he could get a good start ahead of the *Wyoming.*

REPORT OF COMMANDER CUSHING TO THE SECRETARY OF THE NAVY
RECEIVED DEC. 2, 1873.

(Original handed to the Secretary of State by the Secretary of the Navy, December 2, 1873.)

UNITED STATES CONSULATE, SANTIAGO DE CUBA, NOV. 16, 1873.

SIR: As a steamer is unexpectedly about to leave here for Havana in an hour's time, I write this at the Consulate, as I have not time to go off

to the ship and do so. I left Aspinwall on the morning of the 11th instant, in consequence of urgent telegrams from the United States vice-consul at Santiago. He represented the urgent need of a man-of-war, and had received no answer to his dispatches to the consul-general in Havana. He described the shooting of the captain and a large portion of the crew of the *Virginius*, and said that more American lives were in immediate peril. I deemed it my duty, therefore, to take the responsibility of coming here.

The trial took place before a drum-head court-martial, ordered by the commanding general of this department, and fifty-three men were summarily shot.

There are more in prison who are subject to the same fate if tried. Our vice-consul was treated with great disrespect by the Spanish general when he made his protest. I enclose, herewith, a copy of letter that I have to-day sent to the commanding general. I will send all correspondence by the next opportunity. The court-martial and shooting were authorized at the sole responsibility of the general to whom I have written. The British steamer *Niobe* is here, and has demanded that none of the British citizens who are imprisoned shall be executed until the whole matter is investigated by the higher powers.

I shall await the orders of the Department, and protect American citizens in the best manner that is possible. I do not think that any more of the *Virginius'* crew will be executed at present, or that the court-martial will try them until orders are received from Havana. I will write by the regular steamer leaving two days hence, and give a detailed account of matters, and my full reasons for coming, enclosing the telegrams received at Aspinwall that induced me to leave there. Our vice-consul has sorely needed backing, and has sent complaints to the consul-general at Havana regarding the insulting letters and personal behavior of the general who commands this district, in answer to his proper official protests against the barbarous order of the general to treat the crew of the *Virginius* as pirates. When this matter is over we can return to Aspinwall, as we left some important matters there unsettled. (Signed.) W. B. CUSHING.

A few days later the U. S. S. *Juniata* arrived commanded by Commander D. L. Braine, the same officer who once before had relieved Cushing at Smithville, N. C., in January, 1865, and Cushing sailed away from Santiago—having discharged his duty well, for which he received the commendation of a Committee of Congress.

HOUSE OF REPRESENTATIVES—REPORT NO. 781. 43D CONGRESS. 1ST SESSION.

SIR LAMBTON LORRAINE.

June 22, 1874.—Laid upon the table and ordered to be printed.

Mr. Orth, from the Committee on Foreign Affairs, submitted the following report: To accompany joint resolution H. Res. 88.

The Committee on Foreign Affairs, to whom was referred the joint resolution (H. Res. 88) tendering the thanks of Congress to Sir Lambton Lorraine, of the British Navy, have had the same under consideration, and report:

int resolution provides:

> t the thanks of Congress are eminently due, and are tendered, to Sir Lambton Lorraine, commander of the igate *Niobe*, for his humane and generous interposition tiago de Cuba in protecting the lives of the survivors e *Virginius* expedition. The American people with admiration and gratitude his prompt and emphatic admonition which aided to arrest the progress of butchery, and so long as heroism in defense of humanity is deemed worthy of honor, the name of the gallant officer should he cherished.

In examining the history of the transaction referred to in said resolution, your committee find that the steamer *Virginius* was captured on the high seas by the Spanish man-of-war *Tornado* on the 31st day of October, 1873, and immedately thereafter by the said man-of-war taken into the Spanish port of Santiago de Cuba.

That a few days thereafter, on or about the 4th day of November, 1873, and before sufficient time had elapsed for the interposition of foreign powers, four of the persons found on board of the *Virginius* at the time of her capture were tried, convicted, and executed under the Spanish authorities in the island of Cuba. That neither of the four persons thus executed were citizens of the United States, three of them being subjects of Spain and the fourth a subject of Great Britain. That three days after the execution aforesaid, to wit, on the 7th day of November, 1873, the British war steamer *Niobe*, in command of Lorraine, arrived at Santiago, and on the following day he (Lorraine) held an interview with the Spanish general, Burriel, and made an urgent appeal in behalf of the lives of the British subjects until such time as he should be able to present certain considerations in support of the position he had assumed with reference to the British subjects on board the *Virginius*, all of which appear more fully in the following letter of Lorraine to Burriel, dated November 9, 1873:

* * * * * * * * * * *

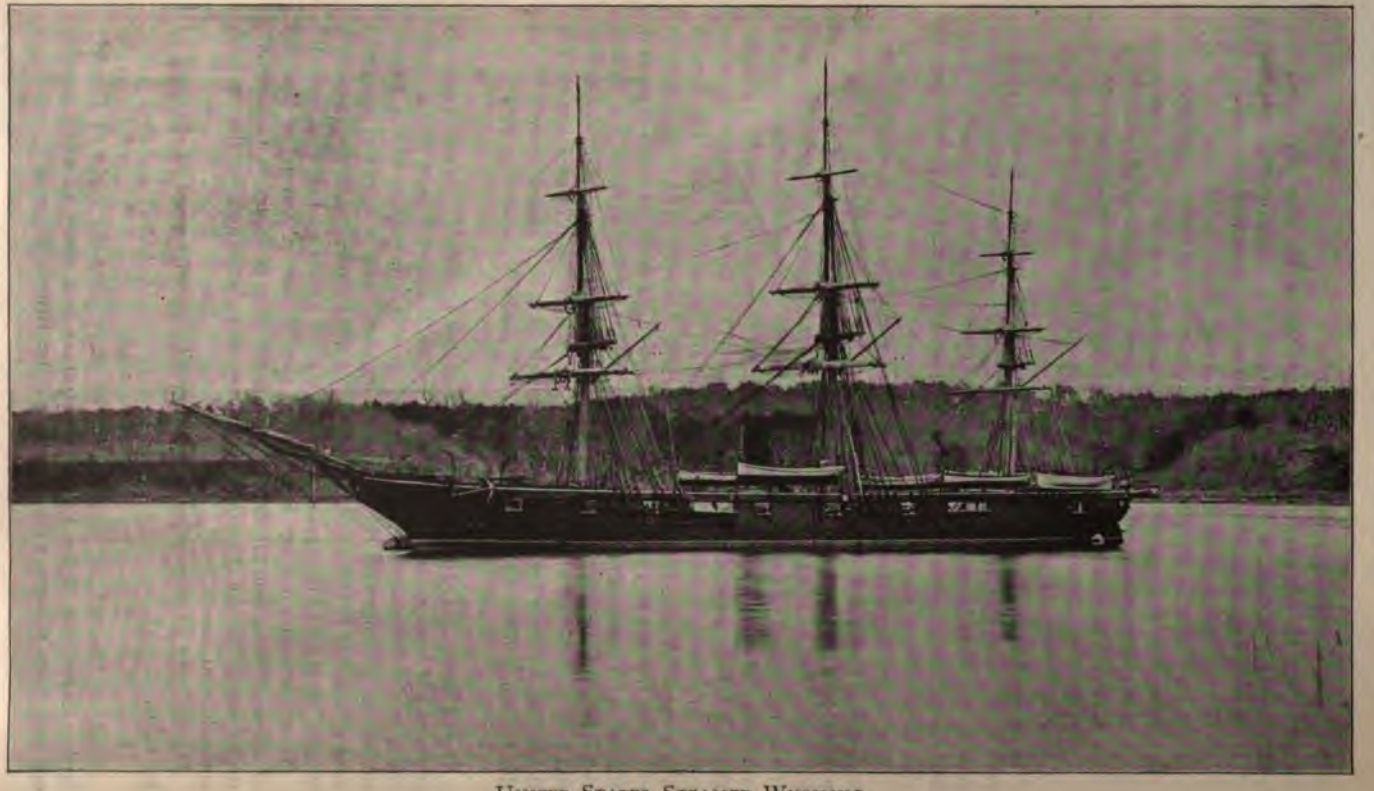
It will be perceived from this letter that Sir Lambton Lorraine expressly confines his interposition and request to the British subjects alone, implicated in the *Virginius* expedition, with the single exception of "A French subject, a passenger on the steamer *Virginius*," and at no time, so far as your committee is informed, interposed in behalf of any American citizen, except "to beg of his excellency (Burriel) the exercise of clemency to all."

Your committee further find that on the 8th day of November (the day of the interview, and the day preceding the note of Lorraine to Burriel), twelve more of the *Virginius* prisoners were executed by the Spanish authorities aforesaid.

On the 11th of November, 1873, General Burriel replied to the note of Lorraine.

* * * * * * * * * * *

That on the 13th of November (two days after the reply of Burriel) farther executions of the *Virginius* prisoners took place, of which number not less than sixteen were reported to be British subjects.



UNITED STATES STEAMER WYOMING.

Commanded by Cushing from July 11, 1873, to April 24, 1874.

That on the night of the 15th of November, 1873, the United States steamer *Wyoming*, Capt. W. B. Cushing, arrived at Santiago de Cuba, and on the morning of the 16th of November he addressed to General Burriel, in the name of the United States, a firm protest.

* * * * * * * * * * *

The committee append the entire note of Captain Cushing to General Burriel, from which it fully appears that Captain Cushing did his duty completely and gallantly in asserting the rights of the American Government and its citizens, and upholding the honor of the American flag.

UNITED STATES STEAMER "WYOMING," SANTIAGO DE CUBA,
November 16, 1873.

SIR: I have the honor to address you this communication regarding the capture on the high seas of the United States merchant-steamer *Virginius*, and the events succeeding such capture. From an inspection of the official books at the United States consulate at Kingston, Jamaica, I find that the *Virginius* cleared from that port for Port Limon on the 3d day of October, 1873. Her sailing-papers, including register and all necessary documents coming under the supervision of the United States consulate, were all certified by the proper authorities. She sailed in ballast, but took out sixty-four haversacks. On the 31st day of October this vessel was pursued and captured something like seventy miles from Cuba.

The *Virginius* has now been sent to Havana to the jurisdiction of the court of admiralty. The question of the lawfulness of this capture on the high seas and out of the jurisdiction of Cuban or Spanish authority is one to be decided, first, by the courts of the captor, after which, if which (sic), if the decision is not in conformity with the accepted custom and laws of nations, the United States Government may reclaim the vessel. The rule of international law in such a case is as follows: "The jurisdiction of the court of the capturing nation is conclusive upon the question of property in the captured thing: its sentence forecloses all controversy respecting the validity of the capture, as between claimants and captor and those claiming under them, and terminates all ordinary judicial inquiry upon the subject-matter. But where the responsibility of the captor ceases, that of the state begins. It is responsible to other states for the acts of the captors under its commission, the moment these acts are confirmed by the definite sentence of the tribunals which it has appointed to determine the validity of captures in war." I, therefore, content myself with making protest, on behalf of the nation that I represent, and shall leave that subject to the determination of the laws that are sure to follow it and reach it. In reading the correspondence between your excellency and the consul of the United States in regard to this matter, I see that your excellency repeatedly terms the *Virginius* a pirate. I must respectfully insist that the *Virginius* was in no sense a pirate. The definition of the word pirate in standard works on international law, and by the general agreement of civilized nations from ancient to modern times, is, that of a vessel committing the offense of depredating on the high seas without being authorized by any sovereign state. "Pirates being the common enemies of all man-

kind," such a vessel may be captured on the high seas by the armed vessels of any nation, and taken into port for trial under the jurisdiction of its tribunals. Piracy, under the law of nations, may be tried and punished by the courts of justice of any nation, by whomsoever or wheresoever committed; but piracy committed by municipal statute can only be tried by that state within whose territorial jurisdiction and on board of whose vessels it was committed. So far from being a pirate, as defined by international law, the *Virginius*, if offending at all, was simply a neutral vessel carrying contraband of war, "a blockade runner," or at most a smuggler. She was unarmed, and was lawfully furnished with sea papers, entitling her to navigate the high seas in safety from all men. If attempting to enter a port that was closed by proper authority, and so watched by armed vessels of the state approached that it in fact became a blockaded port, a vessel of a neutral country might, under the laws and agreement of nations, attempt to carry in arms and any contraband of war, subject only to the penalty of capture in transit and confiscation of ship and cargo. No other punishment is permitted by the universal law of nations, to which each individual state must consent. A sovereign state, through its commissioned agents, violating or exceeding such laws, brings itself, not only into serious complications with the nation whose flag and authority the captured vessel bore on the high seas, but it also comes directly in hostile contact with the agreed laws and customs of all civilized nations.

Such, I do not hesitate to affirm respectfully to your excellency, is the basis upon which I question the summary trial, conviction, and execution of the captain of the *Virginius* and all citizens of the United States of America who belonged to his crew. In the eye of the nations of the earth and their well-defined laws, sanctioned by the tests and trials of centuries, such trial and execution is simply murder. I earnestly protest in the name of my country against what has been done, nothing doubting but that the Government of the United States will know how and when to protect its honor. I solemnly protest against the imprisonment or other punishment of any of the living members of the crew or passengers who are either born or naturalized citizens of the United States. I request your excellency earnestly to cease these executions, which must lead to most serious complication. I shall send a copy of this letter to my Government at my earliest convenience, and I respectfully request you to send a copy to his excellency the captain-general at Havana.

Very respectfully, etc.,

W. B. CUSHING,

Your committee are pleased to have it in their power to add that no further executions took place after the reception of this letter by General Burriel.

In view of these facts, your committee believe that said joint resolution ought not to pass; and they report accordingly to the House, and ask to be discharged from the further consideration of the subject.

FROM THE ANNUAL REPORT OF THE SECRETARY OF THE NAVY ON THE OPERATIONS OF THE DEPARTMENT, 1874, PAGES 9 AND 10.

The North Atlantic Station.—At the date of the last report the whole available force of the Navy which could be put afloat on the Atlantic Ocean was under orders to re-enforce this station. In addition to the regular force as stated in the last report, every available wooden and ironclad ship in ordinary was dispatched as rapidly as it could be put in order and properly manned and organized. The *Lancaster* and the *Ticonderoga* were recalled from the South Atlantic, and the whole European fleet from the Mediterranean, and ordered to concentrate at Key West. The force thus concentrated in the station consisted of the *Franklin, Minnesota, Wabash, Canandaigua, Shenandoah, Juniata, Ossipee, Wachusett, Powhatan, Wyoming, Kansas, Shawmut, Saugus, Mahopac, Manhattan, Ajax, Canonicus, Dictator, Despatch, Pinta, Fortune,* and *Mayflower,* and Rear-Admiral Case, as senior officer present, assumed command, in pursuance of orders to that effect, January 3, 1874, the date of his arrival at Key West. Rear-Admiral Scott remained in command of a division.

The causes which led to this concentration of force were generally and briefly alluded to in my last report, and it may now be proper, in order to complete the record of the action of the Navy in connection with the *Virginius* affair, to recite the more prominent of the proceedings in relation thereto in which it took part.

Commander Cushing, of the *Wyoming,* upon receiving information, through dispatches from the consul-general of the United States at Havana, of the capture of the *Virginius* and the execution of a part of her crew, very properly sailed immediately from Aspinwall, where he was then stationed, to Santiago de Cuba, arriving there on the 16th of November. He put himself at once in communication with the authorities of the port, and protested against the further execution of prisoners of the *Virginius.* In the meantime the *Kansas,* Commander Reed, and the *Juniata,* Commander Braine, then at New York, had been instructed to proceed to Santiago de Cuba for the purpose of inquiring into all the circumstances connected with the capture of the *Virginius* and the execution of members of her crew. The former sailed from New York November 14, and the latter November 19. The *Juniata* reached Santiago de Cuba November 26, and the *Kansas,* meeting with severe weather, did not arrive until December 2. Commander Braine, the senior officer present, entered a protest against the further execution of prisoners of the *Virginius,* and took every means in his power to encourage them and conduce to their comfort. The Department's instructions were judiciously complied with. In carrying out the provisions of the protocol of December 8, the *Juniata* was instructed to receive on board the survivors of the *Virginius,* provide them with comfortable accommodations and convey them to the United States. These survivors, one hundred and two in number, were so received December 18, and safely landed at New York on the 28th of the same month. As another provision of the protocol contemplated the saluting of the American flag at Santiago de Cuba on the 25th day of December, 1873, and the *Canandaigua,* Captain Lowry, was dispatched to

that port to be present when the salute should be given, and to return it. She left the capes of the Delaware, December 12, and reached her destination December 19. This ceremony having by subsequent arrangement been waived, she remained at Santiago de Cuba until January.

In fulfillment of a third condition of the protocol, viz, the delivery of the *Virginius* at Bahia Honda to a war-vessel of the United States, on the 16th of December the *Despatch* was sent to that place for the purpose of receiving her. Captain Whiting, chief-of-staff of the North Atlantic fleet, was intrusted with this duty. The *Virginius* was received at the point and on the day mentioned, provided with a suitable crew, and convoyed to the Tortugas. Here she was placed under convoy of the *Ossipee*, and dispatched to the north. Unfortunately, but unavoidably, in view of her condition and of the fact that she encountered heavy weather, the united efforts of her convoy and of the officers and crew which had been put on board of her were unavailing to save her from the dangers incident to a winter passage on our coast, and she foundered off Cape Hatteras, on her passage to New York. The several officers to whom were intrusted duties of this delicate nature, touching the settlement of an important international question, were instructed to clothe, in carrying out their orders, the firmness required with the utmost courtesy in their intercourse with the officers, both ashore and afloat, with whom they might be brought in contact, and these conditions were studiously observed in every particular.

LETTER FROM LIEUTENANT-COMMANDER CUSHING, U. S. NAVY, TO MASTER PILLSBURY, U. S. NAVY, ON THE U. S. S. "COLORADO," ASIATIC STATION.

NAVY YARD, BOSTON, MASS., April 18, 1871.

DEAR COUSIN ELLIOT: As I suppose that you would not object to a little Navy and Boston gossip, and as I should be much interested in any news from my late cruising ground, I am going to write, with a hope that you will fire back as soon as convenient. I am still in the ordnance here—the senior Lt. Comdr. in the yard—and still eight files from my coveted promotion to the third stripe.

Nearly all the officers have been changed here this winter. Capt. Parker was relieved by Capt. Bryson, and Capt. Hughes has the *Ohio*. Potter has been sent to sea in command of a 4th rate, much to his disgust. Kautz is still here and elated by the proprietorship of a boy baby.

Walker and Nichols are with Spicer in the Equipment, and the Ordnance, headed by Truxtun, is kept alive by B. P. Smith, Schouler and myself.

It is exceedingly dull at the yard, and we have nothing to do but doze in our office chairs, and swear at "Dull Time."

The Armory is turned into a ball room every Tuesday, and quite filled with the yard and city belles and beaux. The floors are waxed, and the Marine Band furnishes the music.

I have been absent all winter, on leave, in Washington, where I had a very gay time amidst balls, parties and receptions.

I had a good time with Milton for the first time in five years, and satisfied myself that he could beat me at billiards. He has been ordered on the practice cruise, and joins the ship on the first of May.

The "High Commission" and the "Low Commission" (San Do.) are both in session, the first-named being busy with champagne excursions with the jolly Robeson, and the others still in bed, with syphons down their throats, drawing off the West India rum that they have smuggled in.

I am enjoying my quiet married life very much, and am completely domesticated. My bachelor habits have gone to the winds—a great saving of dollars and an improvement in health. We are going out of the city to pass the summer, having taken a suite of rooms in Medford.

I saw your mother, Florence, and Lulu two days since, all well and happy, preparing, I presume, for the coming event that will bring you a brother-in-law.

Remember me to Casey, Picking, and other friends. We hear great stories of the beautiful condition of the *Colorado* and her discipline. I am glad that you are having such a good time, and wish you a pleasant cruise, good health, and a safe return.

Don't get knocked over by those confounded Koreans—its better to be killed by white men.

In haste, affectionately,

(Signed.) W. B. CUSHING.

The brave mother who gave three famous sons to the Union cause was an accomplished woman. A few days before the birth of Howard, Mrs. Cushing was impressed with the presentiment of death and wrote in her Bible three verses under the heading "To Milton, with the Legacy of his Mother's Bible." The last verse is given:

Farewell, my son! Perchance through grace
We'll meet again above—
Thine infant memory may not trace
Thy mother's form, thy mother's face;
But O, that mother's love
Burns deep for thee, my first-born child!
God keep thy spirit undefiled!

The mother was highly esteemed by her neighbors as is shown in a newspaper clipping from the *Dodge Co. Citizen,* Beaver Dam, Wisconsin, about December 24, 1864.

In the proceeding of Congress this week we find this item:

On motion of Mr. Rice the House took up and passed the Senate joint resolution, giving the thanks of Congress to Lieut. Cushing for destroying the *Albemarle.*

The destroying of this formidable ram and ironclad was one of the most daring and brilliant adventures of naval warfare, and of course places the name of its hero, Lieut. Wm. B. Cushing, permanently in the annals of fame and makes him a subject of public interest and inquiry.

A few evenings ago a party of citizens of this city, but formerly of Chautauqua County, N. Y., in conversation while taking an oxteam sleigh ride, developed the following reminiscences of Lieut. Cushing's early life. His mother was a widow with three boys, all of them born in Wisconsin, of whom William was the youngest when she settled in Fredonia, Chautauqua Co., N. Y., her husband's native place, for the purpose of giving her sons the best school education she could afford for them. This was about seventeen years ago. She is remembered as a more than usually intelligent lady, cultivated, refined, literary in her tastes, and a faithful and devoted mother. Mrs. F. R. Harris Reid, of this city was then a teacher in the Union School of Fredonia, and Willie Cushing, then about five years old, was the prodigy of the school in the art of "speaking pieces." For a certain exhibition occasion his mother wrote a piece for him and he spoke it, no one but himself and her knowing anything about it till it came out before the audience in his fine graceful delivery, as follows:

Who, with a cheerful, smiling face,
Meets her loved pupils in this place,
  Each morn and never tarries,—
And though the day be wet and cold,
Hastes like a shepherd to his fold?
  Our teacher, good Miss Harris.

Whose dark eye meets each little child,
When fun and frolic, nearly wild,
  Away good order carries?
Who grieves to punish, when she must,
And even then is kind and just?
  Our teacher, good Miss Harris.

I fear we may not keep her long
Amid our noisy little throng;
  But blest is he who marries
The patient, kind, devoted girl—
A precious gem, a priceless pearl—
  Our dear beloved Miss Harris.

A certain well-known citizen, a widower, who, Madame Rumor said, was going to marry Miss Harris, was there present, and this last bit set all eyes on him and made uproarious merriment for the audience who wouldn't be satisfied until Willie came out and spoke his piece over again. (But the *lucky man* wasn't there—Ed. Citizen.)

There are probably twenty or more people in this city and vicinity, from Chautauqua County, N. Y., who remember the widow Cushing and her three little boys, and will recall some of the above facts. Her oldest son, Alonzo, was captain of a battery in the terrible battle of Gettysburg, and refused to retreat after three separate orders to do so from his superior officer: he held his ground, kept his battery playing on the rebels, won the

distinction of having saved the day, but fell at his post of valorous duty and bloody victory. These boys were noted in their school days for pluck and energy, and were always on hand *to fight* for their own and each other's rights, or for any small or feeble child that might be imposed upon by stouter children.

Mrs. Cushing has left on record her own comments on the boyhood of her gallant son William, stating that he was always fond of the water, and a swimmer in babyhood; from a small bridge near the Cushings' Wisconsin home one might have seen any summer day four small images spring into the water, as the brothers were loving, healthy little companions in all their sports. There Will's life was saved from drowning by an elder brother. In Chicago Will took his father's tall hat, slipped away unnoticed, and walked from a pier into the river. After frantic search his parents found him sleeping quietly in the bed of the good wife of the sailor who had rescued him from a watery grave. "The wiver went, and the steamboat went, and I went too," was his explanation of the mishap.

The mother says: "My boys were all fearless, but Will was particularly daring: impatient of restraint but easily governed through his affections; very truthful, loving and sympathetic; quick to feel and prompt to act."

Cushing was a kindly and courteous man in his relations with brother officers and was particularly considerate of youngsters and newly-fledged appointees. A chaplain of the navy tells: "When I received my appointment in the navy a friend gave me a letter of introduction to Commander Cushing, then stationed at the navy yard where I was ordered to report. Arriving at the yard I inquired for Cushing and was informed that he was sitting on a court in a certain building. I proceeded to the building, and found a sentry in the corridor and asked him to take my card to Commander Cushing. He disappeared through a door, soon returned and ushered me into a large room where fourteen officers in full dress sat about a large table. A large man with beetling eye-brows and a great voice demanded "What have you to say to the Court?" I blushed and stammered out, "I would like to see Commander Cushing." The large man, whom I later learned was Commodore Pattison (pronounced *Pat-eye-son* with accent on the *eye*)," said "Commander Cushing this gentleman wishes to speak to you."

Cushing obtained permission to withdraw from the room and spent a few minutes with me in the corridor, kindly explaining that it was impracticable for him to leave the court for long and fixing a time when he would be at leisure. It was my first glimpse of a general court-martial and of Cushing. I shall always retain a strong impression of the courtesy of this man, and also of his keen, bright eye, his animated face, his general appearance of vigor and alertness."

In personal appearance Cushing was attractive and striking, six feet tall, slender and perfectly erect. He said that to this last fact he owed his life at the *Albemarle* affair when a Confederate shot passed close to his spine carrying away the coat and the buttons at the small of his back. His undershirt torn by a grape shot is in a museum in Washington. He carried his head high and shoulders well thrown back which gave him a decidedly military air, and yet he was easy and graceful in his movements which indicated great strength and force. His features were regular and finely cut; his eyes were light blue-grey, but his animation and enthusiasm in conversation rendered them darker in appearance. His hair was medium dark brown, soft and straight, and he wore it long; the mustache of a lighter shade, delicate and silky. He was a good son, husband and father, religious in thought and sentiment, a firm believer in prayer, having received unmistakable proofs of its efficacy in his own experiences. He had faced death many times and he wondered, as a man will, as to what his end would be. His mind rendered him a good companion. He talked well and wrote well. His impulses were fine, noble, courageous. Cushing met, as a bridesmaid at his sister's wedding, in 1867, the charming girl who became his wife at Fredonia, N. Y., in February, 1870, after his return from the *Maumee* and Chinese waters. He always brought home gifts from his cruises. His wedding, attended by many naval officers in uniform, is said to hold the record for the largest clergyman's marriage fee in Fredonia. The bride, Miss Katherine Louise, daughter of Brigadier General David S. Forbes, became a very happy Mrs. Cushing, and she still resides in her childhood home where were born her two daughters, Marie Louise, and Katherine Abell. Just after his marriage, Cushing was ordered to ordnance duty at the Boston Navy Yard, and he greatly enjoyed his first shore duty. He was domestic in his

tastes, made many social calls with his wife, and brought some present home at every opportunity. He was an unusual husband in keeping his wife supplied with more hats and finery than she wanted, and he issued orders that she must always have in her wardrobe a silk gown of a certain shade of blue, the color of the dress she had worn at the time of their engagement in 1867. He was a fluent reader, and fond of Thackeray, Dickens, Tennyson, classics and poesy, which he delighted to read aloud as his wife was busy with sewing or other household tasks. Their first housekeeping was in a little six-room house in the Washington Navy Yard, which he furnished and where he welcomed his wife with babies and nurse to a dinner ready to serve. He enjoyed a busy life, but spent much of his leisure with his wife driving with horse and surrey, enjoying the babies' prattle and all the joys of home. His mother came for a visit in the early fall, of 1874, that dear mother who had been father and mother to him since he was four years old. The first money that he earned as a page he sent to her asking that she buy herself a silk dress. He purchased with his first prize money a home and presented it to her together with $5000 in bank. A portion of his pay was allotted to her support. The proud mother enjoyed Washington and her famous son and charming daughter. Together they enjoyed the thanksgiving sermon of Dr. Newman and a genuine New England turkey dinner. A few days later, an acute attack of sciatica was treated by injections of morphine. A violent mental shock was caused by a brother's misfortune and in his weakened condition the delirium of brain fever followed. In his crowded quarters was little room for a delirious patient and he was taken to the Government Hospital for the Insane, on December 8, 1874, where he could have good care and nursing. His wife and mother were with him, on December 17, when he became conscious and rational, and recognized those about him. While repeating the Lord's Prayer, his voice wavered, and stopped; the gallant spirit was gone, the brave heart still.

Cushing's ashes lie on Bluff Point in the U. S. Naval Academy Cemetery. Within a few feet of his handsome monument lie his friend and commander, Lieutenant-Commander Charles W. Flusser, killed in midnight battle with the *Albemarle,* and another friend and companion in arms who fell in the deadly assault on

Fort Fisher, Lieutenant Samuel W. Preston. He could have chosen no fitter place for his final rest, no better companions for the deep sleep of death.

CUSHING'S TOMB ON BLUFF POINT, NAVAL ACADEMY CEMETERY.

ORDER.

NAVY DEPARTMENT, WASHINGTON, December 18, 1874.

The Secretary of the Navy regrets to announce the death, in this city, at 2.30 p. m., on the 17th instant, of Commander William B. Cushing, of the Navy, an officer of merit and ability, who was distinguished for many acts of daring and courage during the late war.

His funeral will take place on Sunday, the 20th instant, at 2 p. m., from the Commandant's quarters, Navy Yard, Washington.

The Officers of the Navy and Marine Corps are requested to attend in full undress uniform.

GEO. M. ROBESON,
Secretary of the Navy.

The two letters following are given to show Cushing's accuracy of observation just twenty days before his death; and the high approval accorded him by Mr. Gideon Welles. It is fair to say that "Albemarle Cushing" was brave and true, and that he was a man of imagination, sympathy, hope, faith and love.

EXTRACT FROM LETTER, NOVEMBER 27, 1874, FROM COMMANDER CUSHING TO HIS BROTHER.

Thanksgiving has been made, and the day is passed as Mother has probably described in her letter mailed this morning. Mother was delighted with the sermon, her ride to "Stewart's Castle" (as they call it), and other fine buildings, and our visit to Corcoran's Gallery of Art. I was intensely interested, as I had never been there. I was perfectly amazed at the treasures of art that this man has bestowed on this fortunate city. We returned home with rabid appetites for our 5.30 Thanksgiving dinner. Grant came in late to church and sat in the end of the pew next to us—not twelve feet away on my left. I caught his eye once, and he looked me square in the face for about ten seconds, as if he had thought that he had seen me before. I looked with a perfectly impassive face, wondered how thick his neck looked, and how his cheeks were puffed out. He was dressed very plainly, and had on a brown overcoat with velvet collar.

Cox will come into the new Congress a year from next Tuesday with 79 majority of Democrats and Independents, and majority enough on a joint vote to do anything. No more two-thirds or three-fourths majority for the Republican party. Cox is friendly, and I am on no side at all. Rid us of Robeson and I am content. May the party that accepts new and necessary issues win, and may they all cuff each other heartily for supremacy in our next Presidential Election.

LETTER FROM GIDEON WELLES TO MR. E. P. DORR, OF BUFFALO, N. Y.

E. P. Dorr, Esq. HARTFORD, 17th Feby., 1876.

DEAR SIR: I have your letter of the 14th inst., and am glad to learn you are preparing a paper for the Historical Society of Buffalo on the services of the late Lieut. Wm. B. Cushing. You ask me to send such reminiscence as I may call to mind of that young hero which are not matters of record. His brief, adventurous and heroic achievements furnish some of the brightest pages in our naval annals, and my recollections of him are identified with them. Many who knew him not personally, and some who did, fail to appreciate his extraordinary traits of character, and impute his acts of heroic daring to wild and inconsiderate recklessness, but there was in his dashing exploits, not only audacity and intrepid courage, but wonderful sagacity and prudence. Projects which most persons deemed wild and inconsiderate will be found on investigation to have been deliberate and well planned designs, and the results, whether in overcoming or putting to flight superior numbers, naval and military, in lower Virginia, hazardous enterprises in the sounds and rivers of North Carolina, or in the destruction of the ironclad steamer *Albemarle*, demonstrate the wisdom and intelligence which prompted, no less than the courage of the young officer in every instance.

I first saw young Cushing soon after entering upon my duties as Secretary of the Navy. He had just been dismissed from the Naval Academy for reasons which his kinsman, Admiral Joseph Smith, pronounced scholastic rather than naval,—not essential to his profession, and wholly

insufficient to justify such severe treatment. But the Superintendent Captain Blake, and Captain Magruder, Chief of the Ordnance Bureau, who had special charge of the School at Annapolis, declared it was not his first failure, that he was inattentive to certain studies, was boyish and wayward, was wanting in essential elements which were requisite to the make-up of a good naval officer, and that to reinstate him at the Academy would be detrimental. Under the emphatic protest and remonstrance of these officers, he could not well be restored, but I well remember the expression of saddened disappointment and grief which shadowed his juvenile face when informed of the fact.

A few weeks later, when hostilities commenced, he promptly applied for permission to re-enter the Navy, said his passion and his life were in it, and that in some capacity he was determined to live and die in the profession. In the emergency of that period, but without legal authority to act, for Congress had adjourned without investing the Executive with any discretionary power to meet the impending crisis, it became necessary to immediately increase the naval force, and, one of the earliest appointments I made, was that of young Cushing. Sympathy for the youth, whose perseverance, enthusiasm and zeal impressed me, had probably as much influence as the recommendations of his friends in this selection. His gratitude for the appointment was earnest. He said he considered it his first step; that he would gain position, and I should never have cause to regret his re-instatement in the service.

The reports and anticipations of Commodore Stringham, under whom he first served, were scarcely more favorable than Blake's and Magruder's. He thought Cushing too full of levity, too fond of fun and frolic to make a valuable officer. The truth was with his exuberant spirit he had too little to do; his restless, active mind was filled with adventure and zeal to accomplish something that would do himself credit and the country service.

Your paper will, if I understand you, make mention of his bold, skilful and successful exploits, most of which will be found in his own reports, and the reports of his superior officers. I need not, therefore, allude to them further than to say, they were unsurpassed, I think unequaled in number, conception, plan, and courageous execution by those of any officer under the government. Our navy was filled with brave men, ready to do or die, but the youthful Cushing was personally without a rival in prolific schemes, important in their results, and in the hazardous and daring execution of which he always chose to lead. The very audacity of many of his suggestions startled and astounded those to whom they were communicated, but when accepted and accomplished, they extorted admiration.

The official reports of his exploits are interesting, but a narrative of the details, would they be told, would be found to equal those of wild romance.

Possessing the happy faculty of magnetizing and inspiring others, he never failed to procure an abundance of volunteers for his most hazardous expeditions. Foremost in all danger, his men were ever ready to follow, relying on his ready tact, courage, and ability. Notwithstanding his juvenile looks and manner, their confidence in him was unlimited.

In the spring and summer of 1864 great anxiety was felt in relation to affairs on the coast and in the sounds of North Carolina. Most of the troops had been withdrawn for service elsewhere, leaving but a feeble force to retain and occupy the places in our possession. The fleet which had co-operated with the army was composed, necessarily, of light-draft vessels, for such only could enter and navigate the sound. These seemed at the mercy of the *Albemarle*, a formidable ironclad steamer, which had been built on the upper waters of the Roanoke for their destruction. Though this powerful craft had been bravely met, and to some extent injured by our unarmored vessels, several had been sunk or disabled by her, and others remained in constant apprehension of the reappearance of their formidable antagonist.

While the government, and especially the Navy Department, were in extreme solicitude for the welfare and safety of the force, naval and military, in that quarter, young Cushing was permitted, in July, to come to Washington and submit a proposition by which, if the Department approved, he would destroy the *Albemarle*. He was at that time only twenty-one years of age, with a youthful, almost boyish look and appearance, such as would have prevented his proposition from being entertained but for the ability he had exhibited on repeated occasions, and the reputation he had already acquired for daring and successful achievements. In fact, he came to me fresh from the execution of a remarkably bold and hazardous reconnoissance of the harbor and entrance of Wilmington. His earnestness, undoubted courage and the skill and judgment exhibited on repeated occasions inspired me with confidence in him and his project, notwithstanding his youth.

I therefore gave him confidential orders to proceed to New York and report to Admiral Gregory, who on the 7th of August was instructed to "fit out as early as practicable two of the picket boats for Lieut. Wm. B. Cushing." The boats were furnished him, with torpedoes prepared by Chief Engineer Wood. With one of them he reached the sounds of North Carolina, proceeded up the river and sunk the *Albemarle* at the wharf where she was trebly guarded.

This bold and unexampled exploit, be it remembered, was planned and executed by this young officer without adventitious aid or previous training. The government had, at that time, no torpedo station, had not expended millions in experiments and in training its officers for torpedo service. Unsuccessful attempts, and in different ways, had been previously made to do a work which this young officer alone devised and accomplished.

It has not been my purpose, nor does it seem the object of your enquiry, that I should specify or detail the adventures of Cushing. Circumstances connected with his entrance into the service and some of his intercourse with the Department that are not generally known, but which develop his traits, are mentioned. I may add that the great chief of the American Navy, Farragut, who was endowed with like heroism, and for whom *alone*, the office of admiral was created and its honors intended, said to me that while no navy had braver or better officers than ours, young Cushing was the hero of the War.

Very respectfully,

(Signed) GIDEON WELLES.

DETAIL CHRONOLOGY OF WILLIAM BARKER CUSHING.

Nov. 4, 1842, Born in Delafield, Wisconsin.

Sept. 25, 1857, appointed acting midshipman from New York.

Mar. 23, 1861, resigned.

April 1, 1861, appointed acting master's mate in the U. S. Volunteer Navy, and served as such attached to the U. S. S. *Minnesota.*

Sept. 13, 1861, resigned, resignation accepted.

Oct. 19, 1861, warranted as a midshipman from June 1, 1861.

Oct. 25, 1861, ordered to duty in North Atlantic Blockading Squadron and assigned to the U. S. S. *Cambridge.*

Nov. 9, 1861, with Lieutenant William Gwin destroyed the *Ada* in Rappahannock River.

Mar. 27, 1862, detached from *Cambridge* with sick-leave for one month.

May 14, 1862, ordered to U. S. S. *Minnesota.*

July 16, 1862, promoted to lieutenant.

August —, 1862, ordered to U. S. S. *Commodore* Perry as executive officer under Lieutenant-Commander Charles W. Flusser.

Oct. 3, 1862, in severe engagement in Blackwater River, and for great gallantry was placed in command of the U. S. S. *Ellis* a small steamer captured at Elizabeth City, February 10, 1862, and armed with two 12-pounders and a 100-pdr. Parrott rifle, draft 6 feet.

Oct. 19, 1862, burned laden schooner *Adelaide* in New Topsail Inlet.

Oct. 29, 1862, destroyed large saltworks in New Topsail Inlet.

Nov. 23-25, 1862, expedition to Jacksonville, N. C., and loss of the *Ellis* under guns of enemy's batteries.

Nov. 26, 1862, asked permission to take the schooner *Home* into New Inlet to capture Wilmington pilots. With approval of the Department the attempt was made. On return Cushing was ordered to command the U. S. *Commodore Barney.*

April 11-May 4, 1863, senior officer in charge of squadron of twelve gunboats aided army in defense of Suffolk and saved that post from capture, by his own zeal, skill and courage and those of Lieutenant Lamson.

April 22, 1863, led expedition of ninety sailors over land to Chuckatuck, Va., a punitive expedition.

June 24, 1863, led joint expedition to White House, Va.

Aug. 9, 1863, ordered to command the U. S. S. *Shokokon.*

Aug. 22, 1863, destroyed schooner *Alexander Cooper* in New Topsail Inlet.

Aug. 18, 1863, destroyed the blockade-runner *Hebe.*

Sept. 5, 1863, detached and ordered to command U. S. S. *Monticello.*

Feb. 29, 1864, boat expedition to Smithville to capture the commanding general.

Mar. 6, 1864, the U. S. S. *Monticello* rammed and sunk the U. S. S. *Peterhoff.*

May 9, 1864, proposed attack upon C. S. ram *Raleigh.*

June 23-25, 1864, reconnoissance in Cape Fear River.

July 9, 1864, proposed capture or destruction of C. S. ram *Albemarle.*

Oct. 9, 1864, detached from command of *Monticello.*

Oct. 27, 1864, sunk C. S. ram *Albemarle* by torpedo. Commissioned lieutenant-commander from this date.

Nov. 22, 1864, ordered to North Atlantic Blockading Squadron, and Dec. 2 placed in command of flagship *Malvern*.

Dec. 20, 1864, tendered the Thanks of Congress for skill and gallantry in destroying the C. S. ironclad *Albemarle*. Voted silver medal by Union League of Philadelphia.

Dec. 24, 1864, Buoyed out channel and dragged for torpedoes under the guns of Fort Fisher.

Dec. 25, 1864, sounded along the front of Fort Fisher.

Dec. 27, 1864, ordered to command the U. S. S. *Monticello*, and destroyed blockade-runner under the guns of Fort Caswell.

Jan. 13-15, 1865, bombarded Fort Fisher.

Jan. 15, 1865, led assault on Fort Fisher; collected several hundred sailors and relieved U. S. Army forces in trenches.

Jan. 18, 1865, occupied Fort Caswell and Smithville, hoisted Stars and Stripes, relieved by Lieutenant-Commander Braine.

Jan. 19, 1865, decoyed by range-lights and captured blockade-runners *Stag* and *Charlotte*.

Feb. 4-6, 1865, expeditions to Little River and Shallotte Inlet.

Feb. 10-11, 1865, made night reconnoissances in Cape Fear River to near Wilmington.

Feb. 18, 1865, placed "mock monitor" made of an old flat-boat and canvas near Fort Anderson causing the evacuation of that work.

Feb. 24, 1865, detached from command of *Monticello* and wait orders.

March 20, 1865, admitted to the Third Degree of Free Masonry, Star of Bethlehem Lodge, Chelsea, Massachusetts.

May, 17, 1865, ordered to navy yard, New York.

June 24, 1865, ordered to U. S. S. *Lancaster*, Pacific Station.

March 5, 1866, tendered Freedom of the City of San Francisco.

March 11, 1867, detached and wait orders.

Oct. 7, 1867, ordered to command U. S. S. *Maumee*, sailed from Washington Navy Yard, and via Rio, Cape Town, Crater Lake, and Batavia, arrived at Hong Kong the first of May, most of the journey being under sail. June 13-18, 1868, Nov. 20-Dec. 10, 1868, cruising for Chinese pirates.

Nov. 12, 1869, detached.

Feb. —, 1870, married to Miss Forbes, at Fredonia, N. Y.

Mar. 30, 1870, ordered to ordnance duty, navy yard, Boston.

Jan. 31, 1872, commissioned commander.

Feb. 9, 1872, detached and wait orders.

July 11, 1873, ordered to command U. S. S. *Wyoming*.

Nov. 16, 1873, arrived at Santiago de Cuba, 11 a. m.

Nov. 18, 1873, started fires; at 9 a. m. "shifted berth near in."

Nov. 26, 1873, Commander Braine in the *Juniata* arrived at Santiago, and the *Kansas* arrived on Dec. 2.

Dec. 5, 1873, the *Wyoming* stood out of Santiago and arrived at Key West Dec. 10, departed for Aspinwall Dec. 23, returned to Key West, January 22, 1874, convoying the *General Sherman* seized at Aspinwall;

drilled with the great Fleet in February, and was ordered to the Washington Navy Yard to go out of commission.

April 24, 1874, Cushing was detached on waiting orders.

April 27, 1874, ordered to duty as assistant to executive officer, navy yard, Washington.

August 25, 1874, ordered to duty as senior aid to commandant.

Dec. 8, 1874, transferred to Government Hospital.

Dec. 17, 1874, died at 2.30 p. m.

Dec. 20, 1874, funeral from commandant's quarters navy yard, Washington; interment at Bluff Point, Naval Academy Cemetery, January 8, 1875.

Alonzo Hersford Cushing was graduated from West Point in June, 1861, was ordered to Washington without delay, was assigned to training volunteer artillerymen, as first lieutenant U. S. Artillery, and was in command of Battery A, Fourth Artillery of Regulars at Bull Run. He was assigned to the defenses of the Capital, and became ordnance officer for the Second Corps at General Summer's headquarters, January 21, 1862, and in March was in charge of topographic work. In the "seven days before Richmond" he received high praise from General Sumner and in July was transferred to the Topographical Engineers, the highest branch of the army, and was with McClellan at headquarters. At Antietam he served with his battery. On November 5, McClellan was superseded by Burnside, and with Sumner, Cushing continued as topographer. At Fredericksburg, December 13, 1862, he took position beside General Couch who reported: "Lieutenant Cushing was with me throughout the battle and acted with his well-known gallantry." For this he was brevetted captain by the President. After three weeks leave, from January 26, 1863, Cushing resumed command of his battery and never left it until his death. He gallantly served in the preliminary actions before Chancellorsville, and in that famous battle, and was brevetted major from May 2, 1863. With Hancock's corps and with his battery he moved to Gettysburg; he served with that superb soldier as aid, and on the field was brevetted lieutenant-colonel "for conspicuous gallantry at the battle of Gettysburg, July 1, 1863." The detailed histories of that battle, probably the most important land fight in the history of this nation, give mention of Cushing's endeavors on the second and third days of the deadly struggle.

In the afternoon of July 3, Pickett's splendid column of 17,000 American soldiers emerged from the woods across the valley and moved toward the Union center where Cushing held front place. Confederate cannon fired shell over the infantry with disastrous effects on Union bones and flesh. The enemy came nearer, discharging musketry, and Cushing's battery opened with case and canister. Cushing's shoulder was pierced by a musket-ball, but he continued to serve his battery with double and triple charges of cannister that opened immense gaps in the Confederate lines. Again wounded, this time through the abdomen and both thighs he lay propped up against a wheel, dreadfully ill, frightfully suffering, and directed his gallant orderly sergeant Fuger to stand beside him and transmit his orders to the batteries. The gallant Confederate, Armistead, at the head of his men who had been bunched behind the stone fence just in front of Cushing's battery, leaped the fence, charged the battery. Cushing was instantly killed by a shot through the mouth and brain, and the cry "Cushing is killed" rose over the roar of battle. Armistead was riddled with bullets; the arillerymen fought like demons with pistols, sabers, handspikes, rammers, spokes, fists; and then came the onrush of the Philadelphia Brigade. Armistead's men who did not escape were killed or captured. Pickett's charge was ended, and the flood tide of the Confederacy began to recede never again to attain so great a height. Of Cushing's Battery A, with ninety enlisted men and ninety horses at the beginning of the fight, seven men were killed, thirty-eight wounded; two officers killed and one wounded; eighty three horses killed. Nine ammunition chests were blown up and not an uninjured wheel remained. The behavior of the men of Battery A was due to the training and example of this gallant youth on numerous battlefields. The riddled bodies of Armistead and Cushing lay beside the same piece at the very apex of Pickett's charge; foes in life, companions in death.

Howard Cushing at fourteen became a printer's devil in the office of the *Censor* at Fredonia, obtained employment as a printer in Boston, thence went to Chicago as a typesetter on the *Farmer's Advocate,* and in 1861 raised a volunteer company of newspaper men. He was elected captain, but the Illinois authorities did not accept the company. He enlisted in Battery B, First Illinois Artillery, and served through various campaigns including operations

at Vicksburg. On November 30, 1863, he was made a second lieutenant, U. S. Artillery, and assigned to Battery A, Fourth Artillery in which Alonzo had served so well, and with the brave former Sergeant, Fuger, promoted for his gallantry at Gettysburg, Howard took part in many battles of the Army of the Potomac, until May, 1864, when the battery was ordered to Washington to recuperate. On July 9, 1864, he was in the battle of Monocacy, and thence moved to Fort Totten, near Bladensburg, to defend Washington against the raid of General Early. On July 12 the Confederate attack was opposed by Battery A with its three 100-pounder Parrotts. Late in the fall Cushing was sent with his battery to guard the prison at Elmira, N. Y., containing some 12,000 confederate prisoners. Here he restored discipline and maintained order. Cushing was with the Heavy Artillery at Fort Myer, until September 7, 1867, when he was, at his request, transferred as second lieutenant to Troop F, Third Cavalry, and three months later became first lieutenant. Cushing was the pride and boast of his troop, and his courage and deeds are recounted in part in the story of the Third Cavalry, and in a charming volume "On the Border with Crook." In 1869 he drove the Indians in Western Texas. In 1870, after a cruel Indian massacre of a party of thirty whites, he surprised and destroyed almost to a man the offending Indians. Cochise, the predecessor of Geronimo, was the wily Apache chief whom the government coddled in the army camp in the winter of 1870-71, against Cushing's earnest protests. In May, 1871, Cochise went on the war-path and Cushing, on May 5, was at Bear Spring in Whetstone Mountains, Arizona, with a reconnoitering party of twenty-two men. With three of his men, separated from his party, he was ambushed and slain. There was great rejoicing amongst the hostile tribes of New Mexico and Arizona over Cushing's death. Mr. Sylvester Maury wrote of him "He was a *beau sabreur*, an unrelenting fighter; and although the Indians have got him at last, he sent before him a long procession of them to open his path to the undiscovered country."

William Cushing wrote, in part, from Boston to his brother Milton on May 15, 1871:

MY ONLY AND VERY DEAR BROTHER: With a heart full of agony I write to you of our terrible misfortune. Dear, brave "Howie" is no more. I saw the news in the paper at 8 a. m. in the country this morning and hastened in to break it to mother. *Poor dear* little Ma! Her heart is almost broken. Oh *dear* old fellow—we are left alone now—the last of

four: and let us swear to stand by each other and our noble Mother in all things.

Dear old fellow—we must be doubly loving and attentive to little Ma now. Write often to her. One thing is certain of her sons: they cannot be beaten. You can kill but not conquer them.

A beautiful tribute was paid to Lon by the general of his brigade at the great Army of the Potomac meeting here. He described his wonderful, superhuman bravery. He selected Allie as the only one to especially eulogize. God bless the brave boys! I can almost see their meeting—the hand clasp of two who gave up life for duty, and Father joined by his noble Sons, proudly and tenderly embracing them.

God bless you, dear brother! Don't lose love for me. We are alone now. My tears are falling so that I can scarcely see. Good-bye.

With all his heart your loving brother.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

OUTLINE STORY OF THE WAR EXPERIENCES OF WILLIAM B. CUSHING AS TOLD BY HIMSELF.*

I sailed from Boston in the frigate *Minnesota* and reached Hampton Roads early in May of the year 1861. The war had just commenced; the rebels had possession of Norfolk and were forming an army in Richmond.

When our ship with Admiral Stringham on board came into the Roads we found at anchor the *Cumberland, Quaker City* and *Monticello,* men-of-war. On our right hand was Fort Monroe, over which the old flag still waved, while five miles away the sun shone upon a new banner raised in defiance—an emblem of treason. The *Monticello* (which I afterwards commanded) had been in action with the battery on Sewell's Point, receiving several shots and losing a few men, gaining the honor of being the first ship under fire during the rebellion.

We had been at anchor but a day when a fleet of five sail (schooners) loaded with tobacco came boldly down from Richmond. The South, in actual rebellion, thought that none would dare molest them, and that a few of the chivalry unarmed might under cover of the name *Virginian* pass through our fleet of "cringing Yankees" and proceed upon their way, to exchange the fragrant weed for powder and shot that were required for our slaughter.

It is needless to say that we captured them all, and that night I was sailing away for Philadelphia in the prize *Delaware Farmer.* After a narrow escape, in our crazy craft, during a gale of wind, I came to anchor in port, turned over the first prize of the war to the authorities and at once returned to Fortress Monroe, only to be sent off again prize master of bark *Pioneer* bound to New York.

* Paymaster Charles Conard, U. S. Navy, deposited this story in the Navy Department Library in 1909.

Taking passage in June in the frigate *Colorado*, I proceeded to Charleston, S. C., and went on board the *Wabash*, remaining nearly a month, blockading in view of Fort Sumter. Some captures were made, after which I went up to Hampton Roads to rejoin the *Minnesota*. An expedition was fitted out in August to go up the Back River in Chesapeake Bay, to storm a battery and burn some vessels. I was sent in the first launch. We had but a slight skirmish, but burned a number of schooners. The next month the capture of the Hatteras forts was projected.

On the twenty-first of August we left Hampton Roads in the frigate *Minnesota*, flag-ship, followed by a squadron consisting of the *Wabash, Cumberland, Susquehanna, Pawnee, Monticello* and *Harriet Lane*, men-of-war, and three steam transports, bound for Hatteras Inlet, to attack the rebel forts. At this time the inlet sent forth swarms of small privateers, and furnished a convenient harbor for blockade runners, and, as the gate-way to the large inland waters of the sounds, was of great importance. Its capture being determined upon, Admiral Stringham was selected as the commander of the expedition, and entrusted with the largest fleet that had, then, ever sailed in company under the American flag. We came in sight of the forts in the evening of the twenty-seventh and on the morning of the twenty-eighth, by the aid of surf boats, succeeded in landing the few hundreds of soldiers who, under command of General Butler, accompanied us. These took position two miles north of the enemy, and were joined by the marines of the squadron, led by old Major Shuttleworth, who, full of pluck, aspired to carry his wig into an assault that might remind him of former experience in Mexico.

The batteries were earthworks, two in number, and respectively named Fort Hatteras and Fort Clark and were commanded by Commodore Barron, rebel flag-officer. At 10 o'clock the squadron had moved into position in line and the first gun was fired by the *Wabash;* answered by the rebel guns so promptly that their shot seemed but our own rebounding. This was a great moment for me, a youngster who had never been fairly under fire—and I shall never forget or again experience the wild pleasure and excitement that I felt, as the stern challenge and response passed over the blue water on that sunny August day. I commanded the quarter deck division of eight VIII-inch guns, and from my position upon deck had a fair view of every moment during the

day. If I was excited and eager, I was not so, alone, as I remember well our gallant old captain's look as the first whiz of rebel iron came to our ears. With flushed face and sparkling eye he straightened his tall form, and with gray hair bared to the sun, stamped his foot upon the bridge and impulsively exclaimed "Glorious! glorious—closer! closer!"

We were soon in action—every ship a sheet of flame from bows to stern—and at 12.30 the flags from both forts were shot away and the enemy, in the act of abandoning Fort Clark, were rushing madly along the beach, while our shell tore through and through them—and bursting sent mangled bodies high in air, or buried them by dozens in sand graves upon the shore. At 2 p. m. the American colors were hoisted upon Fort Clark, and no flag being displayed from the remaining fortification, our Admiral concluded that it had surrendered, and ordered the *Monticello* to feel her way in and gain its rear. Captain Gillis soon got aground in his attempt and the rebel guns suddenly opening fire, his vessel was in a critical situation. At least fourteen heavy guns were playing upon her at close range, but the *Monticello* promptly returned the fire, and at the same time coolly maneuvered to get out, which she succeeded in doing—in a somewhat shattered condition—covered in her retreat by the concentrated fire of the squadron. At sundown the fleet hauled off shore for the night, and we feared that the morrow might prove stormy, in which case the enemy might not only save their fort, but find our troops at their mercy. In consequence a spirit of gloom and doubt pervaded the squadron that was not lifted until the bright sun and smooth sea of the twenty-ninth proved it good fighting weather, and the signal was hoisted "All hands prepare for action."

At 8 a. m. we were again engaged, the enemy returning our fire in a spirited manner, but not again hoisting their flag after it was shot away early in the fight. The concentrated fire upon the fort was terrific—being mostly from one hundred-, and fifty-pounder guns, fired with great care. Sixty shells exploded inside the parapets in a single minute, and at 11 o'clock an eleven-inch shell penetrated the bomb-proof and entered the magazine, causing the immediate surrender.

A white flag was hoisted and a swarm of rebels appeared upon the fort, while at the same time signal was made to cease firing. Commodore Barron soon came over our side, and surrendered

his sword upon the quarter-deck and we took possession of captured men and property, bringing the prisoners, some seven hundred and fifty in number, on board the *Minnesota.*

An incident must be mentioned that professional men will appreciate. When it was ascertained that an eleven-inch shell had entered the ventilator of the enemy's magazine and thus forced a surrender, every officer in the fleet who commanded a gun of that caliber claimed the honor of the shot, and the dispute was both long and loud until it became known that the fuze cap had not been removed from the projectile, after which no claimant could be found, for no one would admit such a careless act as that of depriving the fuze of its effect.

The prisoners presented a curious and interesting appearance. They were not, in that early stage of the war, content with the ordinary weapons of a soldier, but were loaded down with bowie knives and revolvers, each man a walking armory, evidently endeavoring to justify in dress the awe-inspiring titles they assumed, such as the "Lenoir Braves," the "Tar River Boys," "Hamilton Guards," and "Jonesboro Tigers." These are a few of the ferocious company organizations that I remember, which received the hospitality of the northern prisons as soon as we could take them to New York.

Our victory at Hatteras gave General Butler his first public opportunity of showing that *modesty* for which he afterwards became so conspicuous by making speeches in which he implied that to him the credit of our action was due—whereas the affair was a purely naval one—and General Butler's only part was in placing his name with our admiral's upon the articles of capitulation, and accepting numerous serenades and dinners in the North for a merit which common decency should have forced him to disclaim.

In October, 1861, I was ordered to the *Cambridge,* a purchased screw vessel of about one thousand tons, where I did midshipman's duty until the next March. During this time we blockaded in the Rappahannock River; off Cape Henry; up the James and at Beaufort, N. C. In the first named place I saw some sharp fighting in a cutting out expedition under the command of the gallant Lieutenant Wm. Gwin, afterwards killed in action on the Mississippi River. We cut out a schooner up a narrow stream and were attacked by and defeated a large force of infantry and

artillery sent to take us. In a month we captured over four hundred negroes, or contrabands as they began to call them.

Off the Capes of Virginia my duty as boarding officer was very severe, as it was midwinter, and I was frequently out in open boats for five and six hours at a time with the icy seas and sleet dashing over me continually. Several times I was too stiff upon return to step over the ship's side and had to be hoisted on deck. This caused a sickness that sent me home and nearly cost me my life; but not before the famous *Merrimack* fight in which I had the honor to be under fire, and to lose a few drops of blood.

Our part in the action was to take in tow the sailing frigate *St. Lawrence* and steam with her to where the *Congress* and *Cumberland* were maintaining an unequal contest with the iron-clad and some consort steamers. Before we got under fire the *Cumberland* had gone down, hiding her crushed sides and bloody decks beneath the waters of the James, and a white flag at the masthead of the *Congress* told us that her fate was sealed, and that her brave commander Joe Smith was no more.

The *Minnesota,* which had preceded us, was aground desperately fighting her iron antagonist, whose shots tore through and through the wooden frigate at every moment. The *St. Lawrence* grounded under the fire of the Sewell's Point batteries, and we were soon warmly engaged with the heavy rifled guns of the enemy. With the *Merrimack* we exchanged a few shots just as she was withdrawing for the night. At 8 in the evening we got the frigate afloat, and anchored at Fortress Monroe, preparing for a desperate and hopeless fight on the morrow. It seemed as if nothing could save our wooden fleet from entire destruction, as we were then virtually disabled, but the Providential arrival of the *Monitor* changed the aspect of affairs and we awaited the morrow with an eagerness amounting to impatience. A day, big with the fate of future navies! The sun arose on a calm Sunday morning and glistened on the side of the rebel monster, pressing boldly out in the early day to finish the awful havoc that she had inaugurated.

The *Merrimack* steamed towards the *Minnesota* (still aground) preceded by the steamer *Yorktown,* scarcely noticing a black speck that moved out from behind our frigate, a something far from prepossessing in appearance and calculated to excite laughter, were it not that it bore the grand old flag, that would never

have been risked to be disgraced. "A Yankee hoax," said the enemy; and came on. Suddenly a puff of smoke rolled lazily from the *Monitor's* turret, and the leading vessel of the enemy turned and ran like a beaten cur with a two-hundred pounder Yankee shell in her ribs that had in some way been ejected from the "cheese box" with an aim and force that told of serious work ahead.

The two iron-clads now went to work in earnest fighting at close quarters and exchanging iron blows that cracked sharp and distinct against adamantine sides and sent the echo miles off amongst us spectators, riveting us with intense interest to the scene. It was settled at last. The dear old flag was safe and the national honor preserved, and even the sad fate of the *Cumberland* and *Congress* did not stifle our rejoicing. The slaughter of Saturday was avenged by the victory of Sunday! Not a man had been killed upon the *Monitor;* but her brave Captain Worden was seriously wounded.

The day after this exciting duel we sailed to blockade the rebel steamer *Nashville,* then in the harbor of Beaufort, N. C. She escaped from us, however, in the night, our captain refusing to permit me to enter the harbor and cut her out. He should have worn petticoats instead of the blue and gold of a dashing service, as his subsequent conduct proved, when, neglecting to face the enemy, he received from a court-martial a sentence more merciful than just.

I was by this time quite ill, and was sent home by a board of medical survey, but only remained ashore six weeks before being ordered to the frigate *Minnesota* again. After our capture of Norfolk, I went up the James River upon the staff of Admiral Goldsborough. It was just after the battle of Malvern Hill and McClellan was anticipating a general engagement at Harrison's Landing. My brother was on the staff of old General Sumner, and when we met I was so fired by his story of the "seven days' battle" that I could not resist the temptation, in defiance of discipline, of going on the same service in order to participate in the next affair. While ashore I rode on the staff of President Lincoln to review the army. Returning, disappointed in my warlike anticipations, to Norfolk, I was placed under suspension for leaving my Admiral. But, as a midshipman is hardly considered a responsible being, was soon released.

On July 16, 1862, I was promoted to the grade of lieutenant, jumping the two commissioned grades of master and ensign, and ordered to report for duty on the sounds of North Carolina. Here I became the executive officer of the U. S. S. *Commodore Perry,* commanded by Lieutenant-Commander Flusser, for whose memory I have the greatest admiration. He was a man of clearest judgment, lion-like bravery, and a pure patriotism. We became friends during a heavy fight up the Blackwater River, where he gave me the credit of saving the ship from boarders. The fight originated in a plan of General Dix, who was to move on Franklin with twelve thousand men, while we took three vessels up the Blackwater to cut off the retreat of the seven thousand rebels to be attacked.

The army did not move; we were prompt and at the time appointed found ourselves with two hundred men and fourteen cannon fighting against all the enemy's force. The stream was very narrow and crooked, and at the bends we had to send lines ashore, making them fast to the trees to heave the ship's bows around.

Suddenly turning a point we came bows on to a barricade, formed by felling trees from both banks right across the stream. At the same time we drifted into the left bank. At once every tree and bush and log sent forth a storm of lead, and a yell burst out that seemed to come from all directions.

We were in an ambush. As it seemed madness to fight our few men on an open deck Captain Flusser ordered all hands under cover. In a moment I looked over the side and saw a mass of infantry rushing to board us under cover of their comrades' fire.

Calling for volunteers I dashed out, cut loose the howitzer, (on field carriage), and assisted by six men and an officer, Mr. Lynch, wheeled it to the other side of the deck. By that time I was again alone; all the volunteers being dead or wounded at my feet. Without waiting an instant I sighted the piece and sent the canister crashing amongst the dense mass, now about thirty yards away.

Its effect was fearful and those who were not cut down became panic stricken and fell, all excepting the leader, a splendid looking fellow with long curly hair, who came on, waving his sword, seemingly unconscious that he was alone. He met his death ten feet from our side. The men were now sent to quarters, and a

general fight commenced, the sailors working the great guns, throwing grape and canister, and our marines, shielded by the hammocks, picking the sharpshooters out of the tree tops, from whence they fell with a crash and shriek every moment. Our only hope was now to fight our way out, as no army force appeared to aid us, and six hours followed after the downward movement commenced, filled with attacks and repulses.

We fighting to get possession of every bend, to send ashore our lines, the enemy striving in every way to keep us in the trap. Trees were cut down below us, forming barricades, and rifle pits were thrown up on every bluff and wooded point. But it was of no avail, Yankee mettle was not to succumb on that day. We butted through all obstructions, and made the rebs pay dearly for their sport. In going up stream our ship led the way; in returning the order was reversed, the *Whitehead* being lowest down, followed by the *Hunchback,* while the *Commodore Perry* brought up the rear, bloody and plucky. The leading vessels, rounding a bend, caught the fire of about a thousand infantry, concealed in a rifle pit, and after suffering severely ran by. We were some distance behind, and when we came around were entirely unexpected by the "butternuts" and were right on their flank and only two hundred yards distant. Instantly we threw a fire of shrapnel and grape shot through their trench till we could actually hear the bones crack and see the limbs fly from the mangled bodies. In five minutes the place was in our possession, and that of the dead.

At last, tired and feeble, we fired our last shot, and were clear once more, but with decks covered with the dead and wounded and slippery with blood, and the whole ship like a sieve, so full of bullet holes was she, but we had done our whole duty and could only regret that the army failed us, and that our "blue jackets" had fallen in vain.

We afterwards heard that General Dix had changed his plan and sent a steamer to notify us, but it had reached the sounds a day too late.

Brave Flusser in his short and imperfect report has complimented me upon my conduct; and those who comprehend his character know what a compliment from him means. I am as proud of it as of any in the war.

I was ordered to my first command, the gunboat *Ellis,* a captured rebel vessel. She was of iron, three-eighths of an inch in

thickness, measured about one hundred tons, and mounted an eighty-pounder * rifle gun forward, and a twelve-pounder rifle howitzer aft. As she drew but little water and could penetrate into every nook and corner I was, of course, delighted, and made up my mind to gain distinction or an honorable grave before many months should go by.

The time soon came. Bogue Inlet is an opening into the ocean about thirty miles south of Beaufort. The bar is shallow, the breakers usually high, a tall bluff guards the entrance, and the little town of Swansboro nestles in the rear, about three miles from the mouth. It having been reported to the Government that blockade running was carried on here by means of small schooners to Nassau, I was ordered down the coast to look into the matter. After a slight skirmish, I captured the town; procured provisions for my men and anchored to await events, but soon learning that the rumor of traffic was false, I started down to the southward without orders, intending to have a look into some other inlets.

I dashed into New Topsail Inlet twelve miles from Wilmington. We captured the schooner *Adelaide* with one hundred thousand dollars' worth of cotton and spirits of turpentine on board. She was just about to sail for Bermuda. I was forced to burn her. I soon returned to Beaufort and reported that I had acted without orders, but was complimented highly, and ordered to continue on the coast where I used to coal at Beaufort, and start out upon expeditions in all directions.

Within a week of the destruction of the *Adelaide* I had again attacked the same inlet and after a sharp fight with some artillery succeeded in destroying some large salt works which were of great value, salt being very scarce in the South. In looking at the coast chart my eye fell upon New River, which empties into the Atlantic about forty miles below Beaufort, N. C. I observed that it was wide and deep after the bar was crossed, and that the county seat called Onslow Court House adorned its banks about twenty miles from its mouth. In fact it seemed to me just the place for a nest of Nassau vessels and I determined to make a dash for it.

* The solid shot for the 100-pounder Parrott weighed 100 pounds, the shell 80 pounds. A solid shot fired from the *Ellis* at the Confederate battery in New River Inlet, November 24, was recently found, where it struck, by Mr. Russell J. Coles, of Danville, Va., and is now in his possession.—C. W. S.

EXTRACT FROM CUSHING'S OFFICIAL REPORT.

I entered New River Inlet on the twenty-third of November with the United States steamer *Ellis*, succeeded in passing the narrow and shallow place called the Rocks and started up the river. My object was to sweep the river, capture any vessels there, capture the town of Jacksonville, or Onslow Court House, take the Wilmington mail, and destroy any salt works that I might find on the banks. I expected to surprise the enemy in going up and then to fight my way out. Five miles from the mouth I came in sight of a vessel bound outward with a load of cotton and turpentine. The enemy fired her to prevent her falling into our hands. I ran alongside, made sure that they could not extinguish the flames, and again steamed up the river. At 1 p. m. I reached the town of Jacksonville, landed, threw out my pickets and placed guards over the public buildings. This place is the county seat of Onslow County, and quite an important town. It is situated on the right bank of the river, going up, and is thirty-five or forty miles from the mouth. I captured twenty-five stand of public arms in the court house and postoffice, quite a large mail and two schooners. I also confiscated the negroes of the Confederate post master. I forgot to mention that the town is situated upon the main turnpike road from Wilmington. Several rebel officers escaped as I neared the town and carried the news to that city.

At 2.30 p. m. I started down the river and at 5 p. m. came in sight of a camp on the bank, which I thoroughly shelled. At the point where the schooner, captured in the morning, was still burning the enemy opened fire on the *Ellis* with rifles, but were soon silenced by our guns.

I had two pilots on board, both of whom informed me that it would be impossible to take the steamer from the river that night. High water and daylight were two things absolutely essential in order to take her out. I, therefore, came to anchor about five miles from the outer bar, took my prizes alongside, and made every preparation to repel an attack. All night long the signal fires of the enemy could be seen upon the banks. At daylight I got underway and had nearly reached the worst place in the channel when the enemy opened on us two pieces of artillery. I placed the vessel in position, at once hoisted the battle flag at the fore, the crew gave it three cheers, and we went into action. In one hour we had driven the enemy from his guns and from the

bluff and passed within a hundred yards of their position without receiving fire. Up to this time I had been in every way successful, but was here destined to meet with an accident that changed the fortunes of the day and resulted in the destruction of my vessel. About five hundred yards from the bluffs the pilots, mistaking the channel, ran the *Ellis* hard and fast aground.

All hands went to work at once to lighten her and anchors and steam were used to get her afloat, but without success. The headway of the steamer had forced her over a shoal and into a position where, as the center of a circle, we had a circumference of shoal all around. When the tide fell I sent a party ashore to take possession of the artillery abandoned in the morning, but when they reached the field it was discovered that it had been removed while we were at work upon the vessel.

If I had secured this I proposed to construct a shore battery to assist in the defense of my vessel by keeping the rebels from placing their battery in position. At dark I took one of my prize schooners alongside and proceeded to take everything out of the *Ellis* excepting the pivot gun, some ammunition, two tons of coal and a few small arms. Steam and anchor again failed to get my vessel afloat. I felt confident that the Confederates would come on me in overwhelming force, and it now became my duty to save my men. So all hands were called to muster, and the crew told that they could go aboard the schooner. I called for six volunteers to remain with me on board and fight the remaining gun. Knowing that it was almost certain death the men came forward, and two master's mates, Valentine and Barton, were amongst the number. These gentlemen subsequently behaved with coolness and bravery.

I ordered the schooner to drop down the channel out of range from the bluffs and there to wait for the termination of the impending engagement, and if we were destroyed to proceed to sea. Early in the morning the enemy opened upon us from four points with heavy rifled guns (one a Whitworth). It was a cross fire and very destructive. I replied as best I could, but in a short time the engine was disabled, and she was much cut up in every part and the only alternatives left were, surrender or a pull of one and a half miles, under their fire, in my small boat. The first of these was not, of course, to be thought of, the second I resolved to attempt. I fired the *Ellis* in five places and having seen that the battle flag was still flying, trained the gun upon the enemy so

that the vessel might fight herself after we had left, and started down the river, reached the schooner and made sail for sea. It was low water on the bar, and a heavy surf was rolling in, but the wind forced us through after striking several times. We were just in time, for about six hundred yards down the beach were several companies of cavalry trying to reach the mouth of the inlet in time to cut us off. We hoisted our flag, gave three cheers and were off. In four hours I reached Beaufort. I brought away all my men, my rifled howitzer and ammunition, the ship's stores and clothing, the men's bags and hammocks, and a portion of the small arms. I retained on board the *Ellis* a few muskets, pikes and pistols to repel boarders. I neglected to state that when I took possession of the enemy's ground on the twenty-fourth a salt work was destroyed and ten boats rendered useless that were to have been used for boarding.

At 9 a. m. the United States steamer *Ellis* was blown in pieces by the explosion of the magazine.

After my return to Newbern from this expedition I received from Major-General Foster, commanding the Department of North Carolina, a letter complimenting me on my action and with it a copy of a letter to Admiral Lee in which the general requested that I might be detailed to command a squadron of five army steam gunboats to co-operate with his forces. As I was but nineteen years of age at the time, I thought and still think this a high endorsement of my conduct in command, but I did not second the application, for the reason that I did not wish to relinquish actual naval service and desired one vessel of the navy more than a fleet of army boats. I will only add that as my magazine in the *Ellis* was entirely exposed those who volunteered to remain with me and fight for the honor of the flag, deserve great credit.

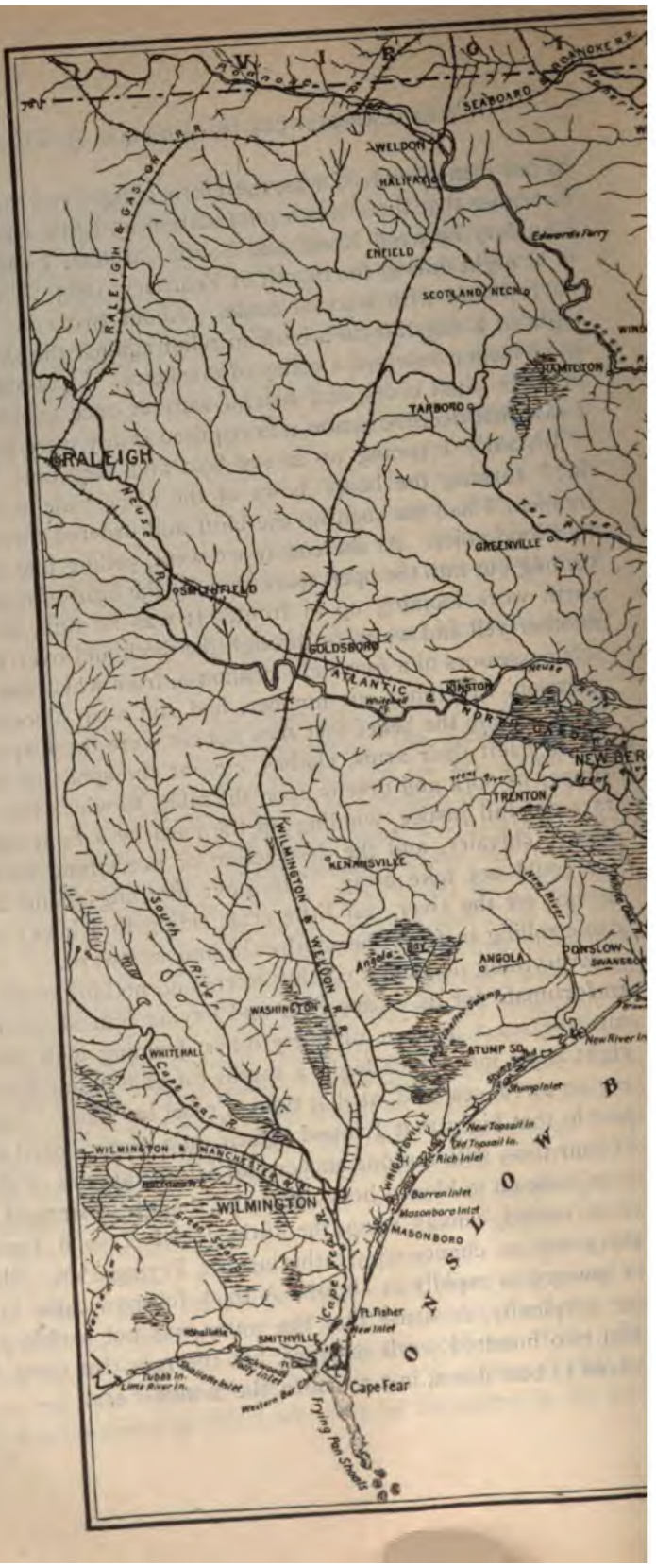
After escaping in my captured prize to Beaufort, I went to Newbern and was for some weeks off duty; but was soon to indulge in an adventure which for real peril and excitement is equal to any. At this time the Government was meditating an attack upon Wilmington, but was in want of some good pilots for that harbor. These I proposed to capture, and, receiving permission, I fitted out a little prize schooner of mine, disguising her as English. My plan was to run boldly in under the forts, take pilot on board and run out, trusting to the boldness of the affair to carry me clear. But at both the east and west bars of that harbor I was becalmed so that I was seen by the enemy in the midst

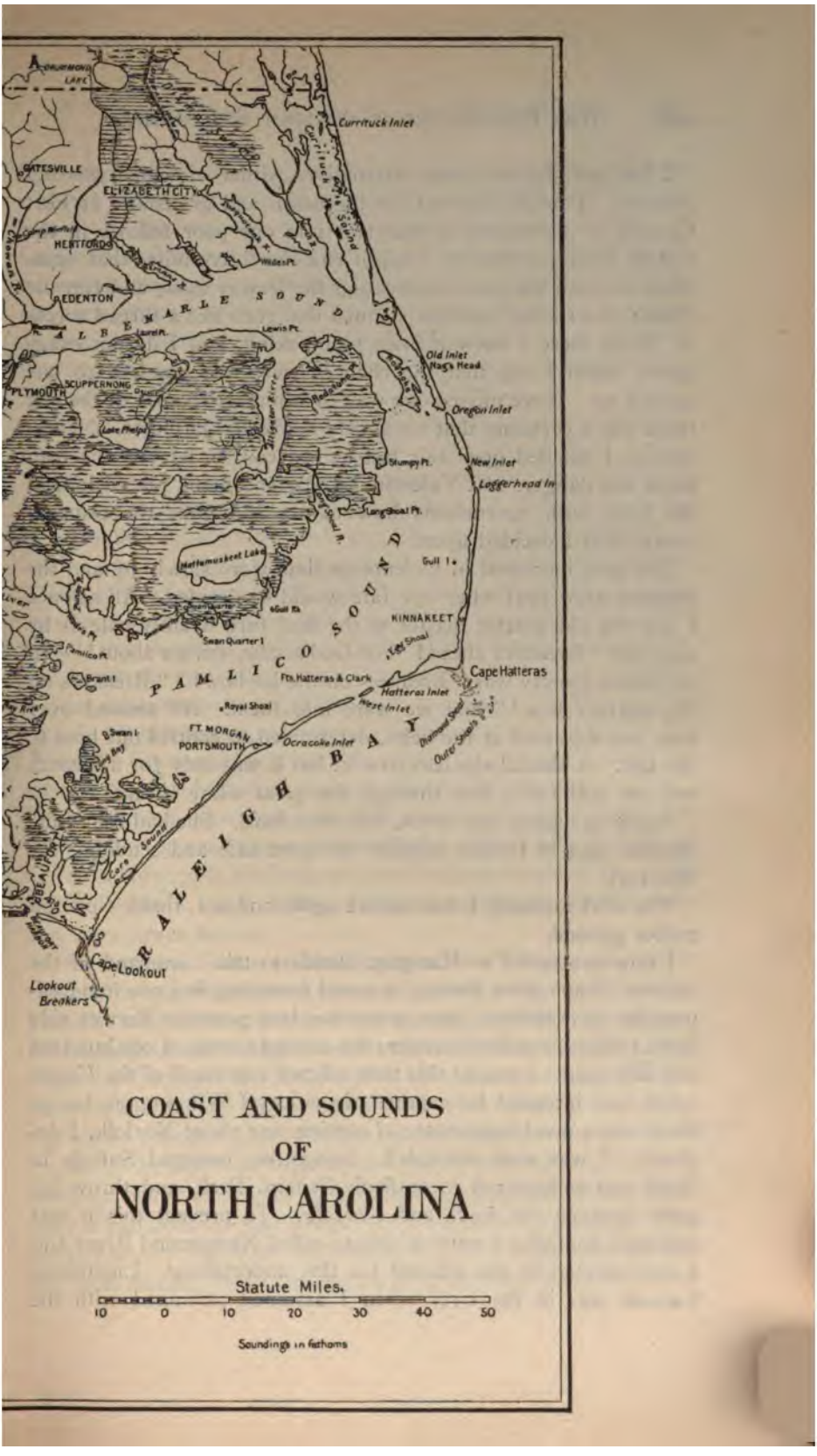
of our men-o'-war. I was, therefore, obliged to change my views. Learning that there was a pilot station up Little River just at the boundary between North and South Carolina, I suddenly dashed in at night during the month of February, 1863. The stream was narrow and with wooded banks. About two miles up I caught sight of a flagstaff on a bluff in relief against the sky, and at the same instant received a volley of musketry. I had but twenty men in three small boats, and several were at once knocked over, but I saw that decisive action was required if any were to be saved.

Instantly I sprang up in my boat and sang out, "Follow me in!" turning the boats' bows at the same time inshore. In a moment I had the men up the bluff and ordered them to charge, in a loud voice. At the enemy we went, yelling like demons, and coming out into the open space saw, by the light of a camp fire, an earth work looming up in front. It was no time to turn back, another yell and we were through the ditch and over the parapet, sole possessors of a fort and blockhouse, from which the frightened garrison, five times our number, had run away deceived by our boldness into the belief that *they* not *we* were the surprised party.

They left their arms, clothes, etc., as the spoils of war, and a supper of pork and greens upon the table, to which our tired jack tars did full justice, winding up the meal by a fight with the returned chivalry, and the destruction of everything valuable that we could not take away. The next morning found us still at anchor off the river, our little craft riding to a heavy swell that came rolling in from the southward and westward.

Everything denoted a coming storm and nothing could be more unfortunate for us. Cape Fear and Frying Pan Shoals make out into the sea a distance of thirty miles, forming with the coast a right angle into which bight a southwest gale blows direct, making an awful sea, and, at that time, a rebel lee shore. And it was just in that bight that I found myself, in a center-board schooner of four tons, with but one anchor and fifteen fathoms of chain. It soon came on to blow a heavy gale and though I managed to keep close reefed canvas upon the little *Home* I soon found that there was no chance of weathering the Frying Pan. She went to leeward as rapidly as ahead. A thick fog now came to add to our perplexity, so dense that the water was not visible at more than two hundred yards distance, but the rain that came with it served to beat down, in a measure, the immense sea.


SEABOARD
WELDON
HALIFAX
Edwards Ferry
ENFIELD
SCOTLAND NECK
HAMILTON
TARBORO
RALEIGH
GREENVILLE
SMITHFIELD
GOLDSBORO
KINSTON
TRENTON
NEW BERN
KENANSVILLE
ANGOLA
DUNSLOW
SWANSBORO
WASHINGTON
WHITEHALL
STUMP SD.
Stump Inlet
New Topsail In.
Old Topsail In.
Rich Inlet
Barren Inlet
Masonboro Inlet
MASONBORO
WILMINGTON
Ft. Fisher
New Inlet
SMITHVILLE
Shallotte
Tubbs In.
Lims River In.
Cape Fear
Western Bar Channel
Trying Pan Shoals
WILMINGTON & WELDON R.R.
WILMINGTON & MANCHESTER R.R.
South River
Cape Fear R.
Angola Bay
Lower Swamp
New River In
Stump Sd.
Channel
Inlet
Shallotte Inlet
Lockwoods Folly Inlet
Cape Fear R.
Waccamaw R.
ATLANTIC & NORTH CAROLINA R.R.
RALEIGH & GASTON R.R.
ROANOKE R.R.
ROANOKE R.
Neuse River
Trent River
Neuse R.
Contentnea Creek
Swift Creek
Brices Creek
Goose Creek
Whitehall
Whiteville
Lake Waccamaw
Green Swamp
Juniper Bay
Juniper Creek
Lumber R.
Waccamaw R.
Cape Fear R.
Lockwoods Folly R.
Shallotte R.



COAST AND SOUNDS OF NORTH CAROLINA

I had my choice of two alternatives, either of which was not pleasant. I might bear up for the beach and go ashore at Fort Caswell as a prisoner of war and join our poor fellows in the hell at Andersonville, or I might run the thirty miles that separated us from the shoal, calculating the leeway made and run the chance of striking a narrow channel that runs like a thread across it. Even there I knew it must be breaking, and I do not exaggerate when I say that the chances were five hundred to one against us. If we missed our way by a hundred yards in the fog there was a certainty that we should be dashed in pieces. Nevertheless, I decided upon this last named course, let but one man know the danger, Mr. Valentine, a master's mate, placed him at the helm with instructions how to act and gave the compass course that I decided upon.

The gale increased in violence as time wore slowly by and the moment drew near when our fate would be decided. All at once I saw the old quarter master at the lead turn deathly pale as he sang out "Breakers ahead! For God's sake, sir, go about!" In an instant the cry was "Breakers on the lee bow!" "Breakers on the weather bow!" and we were into them. All seemed over now, but we stood at the helm, determined to control our boat to the last. A shock! she had struck! but it was only for a second, and she still fairly flew through the great white breakers.

Again and again she struck, but never hard. She had found the channel, and in twenty minutes we were safe and scudding for Beaufort.

The next morning I was ashore again and not, thank God! on traitor ground.

I now proceeded to Hampton Roads to take command of the steamer *Commodore Barney*, a vessel mounting five one hundred-pounder smooth-bore guns, a one-hundred pounder Parrott rifle and a twelve-pounder howitzer: she carried a crew of one hundred and fifty men. I was at this time offered command of the *Violet*, a fast boat intended for capture of prizes off Wilmington, but as there was a good appearance of coming war about Norfolk, I declined. I was soon rewarded. Longstreet besieged Suffolk in April and endeavored to outflank General Peck, and throw his army between our force and Norfolk. To prevent this it was necessary to hold the narrow stream called Nansemond River and I was selected by the admiral for this undertaking. Lieutenant Lamson was in the river when I assumed command with the

light steamers *Mount Washington* and *Stepping Stones.* I took with me besides my ship the tug boat *Cohasset.* The army gunboat *West End* was also in the stream. On the fourteenth, as Lamson was bringing his ships to join me, the *Mount Washington* grounded less than one hundred yards from a bluff, Hill's Point, and about three hundred from where I was anchored. The enemy at once unmasked a battery of rifled guns which were stationed in a sunken earth work on the point; and a fight commenced that was both stubborn and bloody.

The army soon deserted me and I sent the tug down to watch the fords below.

Lamson was soon badly cut up, but fought with the pluck of a hero against what seemed a *fated* destruction. With the rising tide I pulled aboard his ship in my gig, and took the bearings of affairs, and as soon as she would float, ordered the little *Stepping Stones* to take her in tow and run for it. In the meantime the battle was exceedingly warm, as we were never more than three hundred yards from the muzzles of the rebel guns, and were also under the fire of musketry. After five hours of this work the *Stepping Stones* went down stream with *Mount Washington* in tow, the last named vessel a wreck, with over a hundred shot holes in her, but flying the Stars and Stripes from a staff that had been thrice cut away and thrice lashed up again by the gallant Lamson.

The *Barney* was now left alone and in an hour more had silenced the opposing guns and anchored with a loss of many of her crew, two guns disabled, and badly cut up fore and aft. This was certainly a tough fight. For three weeks we fought daily and were never beaten.

The steamers *Yankee, Coeur de Lion* and *Primrose* meanwhile reported to me for duty and took part in the sport. In the contest I met as enemies one who was a classmate at Annapolis and one cousin, both of whom it gave me much satisfaction to defeat. One night our sailors, in conjunction with an army detachment, stormed and captured the sunken earth-work in our front, bringing off six captured cannon. The credit of this was mainly due to Lamson. Another day I landed with ninety sailors and a howitzer, marched inland and captured the town of Chuckatuck, four hours after it had been the headquarters of Longstreet's left wing. This proved a very important reconnoissance, as it demonstrated that the rebel flanking force had drawn back, and, therefore, that their

main body was moving away to reinforce Lee for the expected battle with Hooker's force.

A circumstance of my raid, which at the time furnished much amusement to our army, is worth relating. After driving in the cavalry pickets of the enemy, I ambushed half of the men at some cross roads to protect my rear and then advanced towards the town. Having captured a cart drawn by two mules, I converted it into a limber, placing my ammunition inside and making fast the trail rope of the howitzer to the rear. We could then advance at the double quick. As we entered the streets of the town a rebel cavalry company came charging around a corner two hundred yards away with drawn sabers and horses at a gallop. I instantly unlimbered and blazed away, but the shrapnel just went over them and burst in their rear. At the sound of the gun the mules dashed off at a run, right against the advancing cavalry, with the old cart swinging first to one side and then to the other of the road. Mules and cavalry came in contact in the narrow street and great confusion ensued.

"Load with canister," said I. "All gone in the mule cart, sir!" was the answer. Sure enough! It was all gone and I had not an ounce of ammunition. Something had to be done, so I ordered a charge and the novel sight ensued of sailors charging and beating cavalry. We killed a number, recaptured our cart, took the town and several of the enemies' horses all equipped with pistols at the saddle bows. After mounting the officers a fine horse remained that I desired to save so I shipped an old tar on his back and we started to return.

In going through some woods we were attacked when I again made use of my howitzer, which had the same effect on the old sailor's animal that it had previously on the mules, he went about and shaped a course right back for town.

Jack saw that he was struck by a squall and tried to luff, but it was of no use and as for anchoring it was just out of the question. But discipline in the school of danger now came to his assistance. Quickly pulling out one of the pistols from the holsters he placed the muzzle at the horse's ear and blazed away. The speed of the runaway was great so that it took about a dozen bounds, end over end, to satisfy his momentum, and our jolly "shell back" found himself seated in a ditch with the wreck alongside.

Stripping the rigging off he came in to join us, with the saddle on his back, swearing against a craft that wouldn't answer its helm.

While engaged one morning with two batteries, my bow guns, with one a quarter of a mile away and the broadside against another on Le Compte's Hill twelve hundred yards distant, I had a narrow escape.

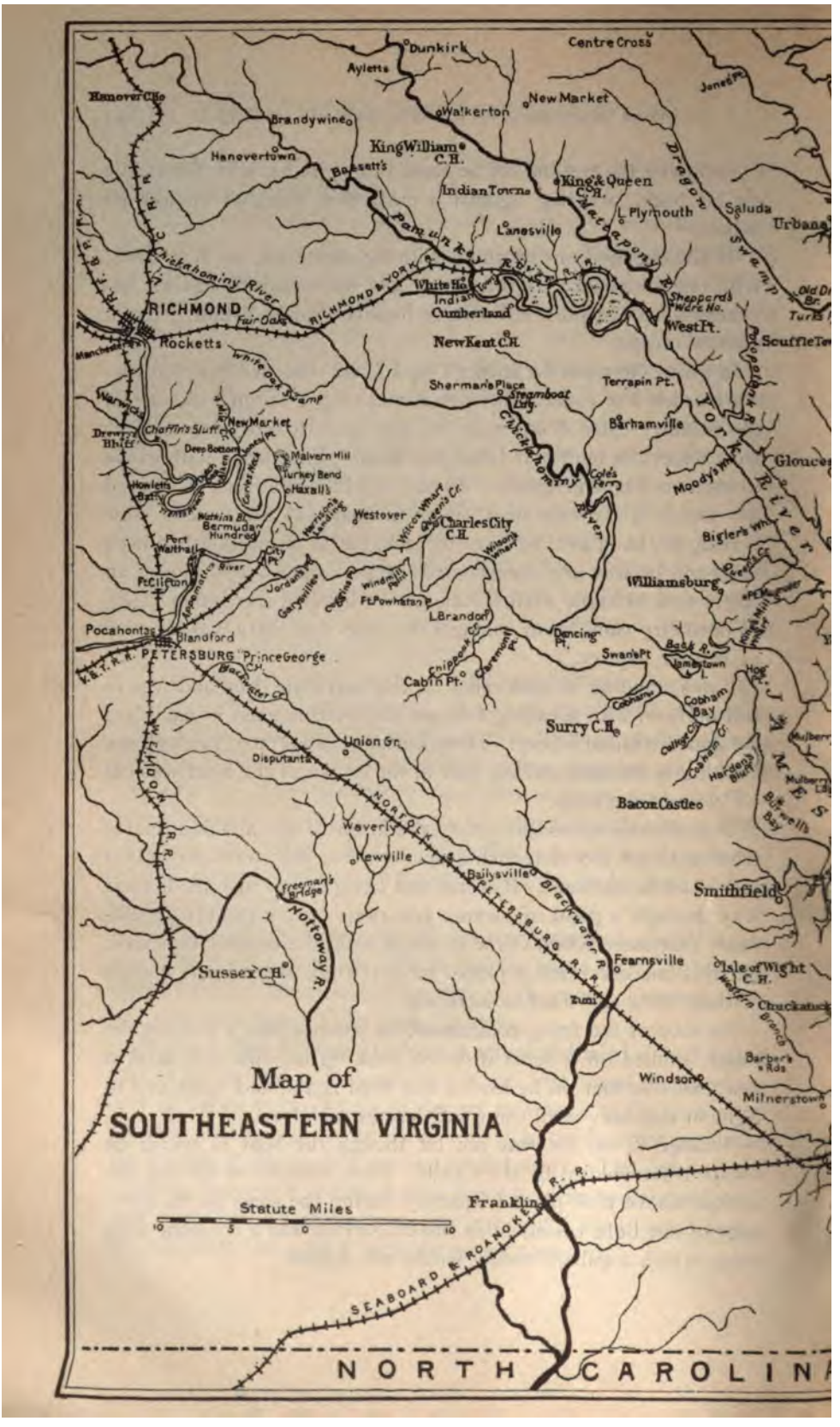
In the woods upon the enemy's bank I had stationed five men who were ordered to conceal themselves and keep a bright lookout. If the infantry came down upon us they were to fire once and retreat under the bluff and I had two heavy guns loaded with grape to meet such an emergency. As our ship in her movements neared the woods I saw one man under the bank at the water's edge waving his hand as if to warn us back, but as no musket had been fired and he was not twenty yards away I sang out to him in an angry tone to know what it meant. As I hailed a crashing volley of musketry came from amongst the trees and there was no need of further inquiry.

I was standing in bold relief on the hurricane deck and was in full uniform with speaking trumpet and marine glass in hand, yet I escaped without injury. Three buckshot penetrated through my clothing to the skin and my hair at the crown of the head was cut off close to the scalp.

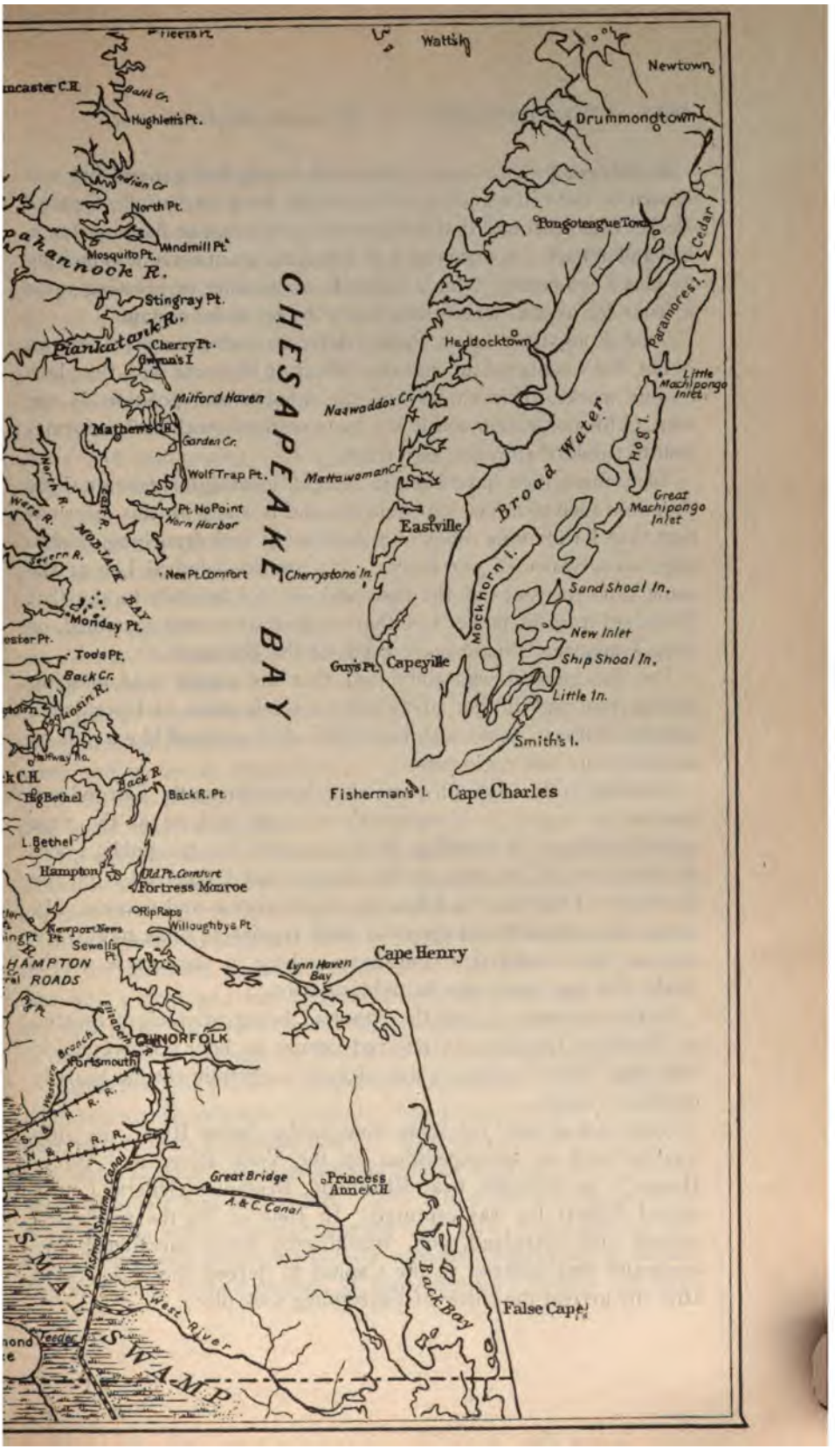
Ten minutes served to satisfy the ardor of the attacking party who could not face nine-inch grape, but they left some of our best men dead on our deck. It seems that Longstreet's men made their way through a point of swamp and came on my pickets so suddenly that there was no time to alarm us in the manner indicated, but this one brave sailor placed himself right beneath the muzzle of their rifles and tried to warn me.

As soon as the firing commenced he jumped into a boat on the beach, sculled off a short distance, took up his rifle and fired, a few yards further on he loaded and fired again, and continued to fight in that way until the Confederates withdrew.

Strange to say he was not hit though the boat in which he escaped was riddled by sixty balls. Such contests as the one described above took place frequently during the siege as the presence of our light vessels in so small a stream was a constant challenge which a gallant enemy would not decline.



Map of SOUTHEASTERN VIRGINIA


Fleets Pt.
Watts I.
Newtown
Drummondtown
Pongoteague Town
Cedar
Paramores I.
Little Machipongo Inlet
Great Machipongo Inlet
Hog I.
Broad Water
Haddocktown
Nassawaddox Cr.
Mattawoman Cr.
Eastville
Mockhorn I.
Sand Shoal In.
New Inlet
Ship Shoal In.
Little In.
Smith's I.
Guy's Pt.
Capeville
Cherrystone In.
Fisherman's I.
Cape Charles
CHESAPEAKE BAY
Hughlett's Pt.
North Pt.
Windmill Pt.
Mosquito Pt.
Stingray Pt.
Cherry Pt.
Milford Haven
Mathews C.H.
Garden Cr.
Wolf Trap Pt.
Pt. No Point
Horn Harbor
New Pt. Comfort
Monday Pt.
Tods Pt.
Back Cr.
Back R.
Back R. Pt.
Big Bethel
Little Bethel
Hampton
Old Pt. Comfort
Fortress Monroe
Hip Raps
Willoughbys Pt.
Newport News Pt
Sewells Pt.
HAMPTON ROADS
Lynn Haven Bay
Cape Henry
NORFOLK
Portsmouth
Great Bridge
Princess Anne C.H.
A. & C. Canal
Back Bay
False Cape
West River
SWAMP

In this campaign it is my opinion that very bad generalship was shown by the commanding officer of our army in Suffolk, General Peck. When I found that Longstreet's left wing, or flanking force, had fallen back I at once concluded that his main force was moving to join Lee because it must either be so moving or massing upon a front for assault where they knew defeat to be certain.

That Longstreet knew Peck's defenses and numbers I cannot doubt, for I captured an engineer officer of his force with the plans of our works, their names and the number and position of our men, in his possession and it was mere madness with such information to think of storming our front.

They must then have been in retreat, leaving but two or three thousand men to amuse our general, and it was with this information that I rode nine miles in a dark night and drenching rain to urge an advance of our forces. I wrote to Admiral Lee at the same time the state of the case and did not hesitate to say that Peck had it in his power to either capture what men remained, or keep Longstreet's main body north of the Blackwater.

But the general was convinced that the enemy was massing on his front and did not advance for a week when, as I predicted, a mere shell was found, a skirmish line, that went off like a puff of smoke before our regiments.

Admiral S. P. Lee will remember how constantly I urged my opinion in regard to Longstreet's strategy and he at the time agreed with me in thinking Peck too timid for the public good. At the close of our duty in the Nansemond I received from the Secretary of the Navy a letter of congratulation and thanks. My vessel was so badly cut up as to need repairs at some navy yard and we were ordered to Baltimore, where in the course of six weeks she was again put in fighting trim.

In the meantime I had the honor of being privately presented to President Lincoln and enjoyed keenly an hour's conversation with him. His Excellency was pleased to compliment me heartily upon my success.

After doing duty for some time in the James River, my ship was ordered on an expedition up the York River to "White House." In this raid, near Richmond, Brigadier General Lee, a son of Robert E., was captured. In June of '63 the rebels advanced into Maryland, and, Washington being threatened, my command was ordered to the Capital to defend the city. Soon after my arrival the battle of Gettysburg took place.

In that action my brother fell fighting most nobly in command of Battery A, Fourth U. S. Artillery.

I at once proceeded to the field with the double purpose of securing his body and, as all his officers were killed, of fighting his guns, if permitted to do so, in the next battle. The field, when I reached it, was a sickening sight. Thirty thousand wounded men and thousands of unburied dead lay on the earth, in road, field, wood and orchard, and under the scorching sun on the bare hillside amidst all the wreck of a great battle. Dismounted cannon, dead horses, exploded caissons and broken muskets were everywhere and the artillery position on Cemetery Hill was almost paved with the rebel iron that had been hurled by the hundred and fifty guns massed against it previous to the final charge.

My brother's battery was destroyed. Five out of the six guns were dismounted, all the officers and most of the men were shot and seventy of its horses stiffened upon the wooded knoll where they were placed for shelter. Our army had moved on in pursuit of the foe and there was nothing left for me to do but to return to naval duty.

As I write this, rocked on the long swell of the Pacific, under the warmth of an equatorial sun, my mind goes back in review of the many sad scenes in those bloody years of rebellion but fails to bring up any picture that is so grand or solemn or mournful as that great theater of death.

The wounds were not alone for those who fell upon the field. There is suffering greater than the dying know, the prolonged anguish of those left behind to mourn them.

In the month of August, 1863, the steamer *Shokokon* was sent upon the blockade as an experiment of the Navy Department. She was a large and fast ferry boat with the hull built out, and, supposing her then to be seaworthy, possessed many advantages in maneuvering amongst the shoals off Wilmington harbor.

Hardly had she gained the squadron on the coast, ere, without a trial, she was pronounced seaworthy and ordered by the senior officer to return to Hampton Roads. This did not suit the ideas of our admiral, and, her commanding officer being relieved, I was ordered to her and sent to sea. Now *I* had serious doubts as to whether she would survive a good stiff gale, but made up my mind to find out, consoling myself with the philosophy of Bryan Bolin, "That there's ground at the bottom." Within the first

week we drove ashore the large blockade running steamer *Hebe* while endeavoring to run in and though prevented by a gale of wind from towing her off, succeeded in burning her after a sharp fight with a rebel battery of rifled guns.

Two days after I discovered a vessel in New Topsail Inlet and requested permission to cut her out, but the senior officer declined to permit it upon the curious plea of "risk of life" and responsibility.

I, therefore, determined to try it without permission. By sending in boats we discovered that a battery of six guns guarded the mouth and that the distance to the wharf at which our coveted prize was secured was about six miles. Strategy was required to insure success and avert blood shed. I anchored the *Shokokon* close into the beach, about four miles to the northward of the mouth of the inlet, which position left me separated by about half a mile from the sound inside, the intermediate land being covered with scrub oak. The enemy seeing us at anchor concluded that a boat expedition was preparing to go in at the mouth of the opening and made every preparation for our reception.

One gun, with twenty men and the captain, went up to the wharf where the piece was pointed to rake the deck of their vessel, the other guns were left, ready to blow us out of water, in their original position. Then men were posted at the mast heads of their craft and all was deemed secure.

Night came and so did the Yankees. Instead of going in at the mouth of the inlet I took ashore, four miles above it, two boats' crews, made them shoulder the dingey (a very small boat) and carry it across the neck of land, launching it in the reeds two miles from the blockade runner and in a position entirely outflanking the main battery. To shorten the story, we surprised and charged in the night with six sailors the force guarding the schooner, routed them, took their artillery and ten prisoners, including the captain, burned the vessel and destroyed some large salt works. In doing this two men were thrown out as pickets, two guarded the prisoners and two, assisted by the plantation darkies, burned the vessel and buildings. The prisoners proved an elephant in our hands for the dingy was entirely too small to bring them off and it was impossible to guard them in moving through the thick brush in the darkness. A great show of orders was, therefore, made to imaginary boats off upon the water and

ordering three of the prisoners into the dingey the rest were instructed to go a quarter of a mile up the bank and report to a Lieutenant Jones, who was supposed to be there to receive them. They were cautioned not to go too far out, or our pickets might shoot them, and went off without an idea of the smallness of our force, or our inability to take them with us.

The next morning, upon coming in sight of the squadron, I found them in by the beach engaging a battery which was situated near the wreck of the *Hebe*. Knowing the water well I got a position close in and proceeded to serve out grape and canister, but becoming impatient, hoisted signal for permission to board. Not receiving an answer I went on board the admiral's ship and asked permission to take the guns by storm. This proposition was declined as it was intended to shell them a while longer and then to land two hundred sailors and marines to cut the enemy off. But to be within grape range and not act was too much for my patience. I lowered two boats upon the side away from the enemy, took twenty men and in a moment dashed around the stern and ashore. We took two rifled pieces, one a Whitworth, and when assistance came from the flagship got them off my vessel.

I never was credited officially with this, perhaps because I disobeyed orders, or, maybe, for the reason that the great fish present could not surrender so dainty a morsel to a youngster. Shortly after this we were caught in a very heavy northeast gale and were nearly lost. All the ships had to run to sea and my only chance was to get around the shoal under the lee of Smith's Island. This I succeeded in doing but only when my sponsons were knocked away, decks raised and boiler wrenched from the hull by the storm. It was close work and quite experiment enough. So thought Admiral Lee, who believed us under water until we steamed to meet him upon his return two days after. I was detached from the *Shokokon* and ordered to Washington as bearer of despatches. That I was not forgotten in these, I judge from the fact that I was ordered to command the *Monticello*, then fitting out in Philadelphia, Mr. Fox saying: "You are ordered to this command for distinguished services rendered."

I was now ashore for some months superintending the outfit of my vessel. The times were decidedly squally, the electioneering feeling in Pennsylvania running very high. I was glad enough to get to sea again after being placed in "durance vile" for thrashing

a few of the "copperheads" who insulted me for no other reason than because I wore the uniform of my country's navy. In February, 1864, I was off Wilmington blockading. In the day time we had stations for anchoring out of range of the enemy's shot. In the night each ship crept close in along the bar, the lead colored hulls blending in with fog and foam and every eye alert to catch sight of an entering or escaping steamer. Great care was required not to run ashore and to avoid being disabled by the rebel fire when the moon came out and found us close under a hundred of their cannon.

I was forced to get all the sleep that I required during the afternoon, never at night.

They had a practice ashore of trying to disable us by pointing a number of guns with different elevations in the same plane of fire, so that when all were fired one was apt to take effect. Besides the line of ships close in, there was a squadron in position well off from the coast. It was the duty of these cruisers to calculate for moon and tide, the time that a steamer would be most likely to escape from the harbor and supposing her to make through the night a certain number of knots speed, place themselves where they would probably sight the black smoke in the morning. The lookout at the mastheads commanded a horizon of some fifteen miles and many a steamer was so seen and captured. As the sun commenced to light up the ocean the hail would come from aloft, "Black smoke, sir!" "Where away?" "Two points on the port bow, sir!" and the exciting chase would commence.

It was exciting. Sometimes a few hours sufficed in which to overhaul the lead colored fugitive, often darkness would terminate an unsuccessful chase and our blue jackets would have to console themselves by the saying that "there are as good fish in the sea as ever were caught," a poor substitute for the half million dollars that had run away from them during the day. In many of these races the "runner," when hard pressed, would throw overboard her deck load of cotton and it was not an uncommon thing to see a hundred thousand dollars' worth of the "royal staple" floating unheeded by.

On the night of the twenty-second of February the *Monticello* was inshore off Fort Caswell and I made up my mind that the birthday of Washington was entitled to a celebration. I, therefore, muffled the oars of three of our boats and with forty men succeeded in passing in between the forts into the harbor.

My object was to find a prize inside, capture her by boarding and run out by their guns to our squadron.

There were no vessels at the anchorage so I thought of dashing into a heavy battery on Smith's Island and bringing off its flag. Pulling in with my gig to reconnoiter, I found that when my oars grazed the face of the work I was not challenged. The rebels felt perfectly secure and had grown careless. As my force was small I determined to give no alarm but to get reinforcements from the squadron and with the senior officer's permission to take and *hold* the island until relieved by the army force. Such an event would have closed to the enemy one of the troublesome entrances to Cape Fear River. I could have effected this result with two hundred men, but as usual met the reply to my proposal, "Can't take the responsibility." This, I confess, provoked me and I told the senior officer I could not only do that, but if he wanted the Confederate general off to breakfast I would bring him. I then left and went to my ship.

That night I took twenty men, pulled by the forts and straight up the river to the town of Smithville, the rebel headquarters. I knew nothing of it excepting that fact and its position on the chart, but my plan was too bold to fail. I succeeded in landing right in front of the hotel not thirty yards from the angle of the fort, in the center of the town, and hid my men under the bluff. We then crept down to a salt work on the point and captured two darkies who were there at work, thus gaining what information I desired. My object was to take the commanding general from his bed, in the midst of his men, and to take him out of the harbor in one of his own steamers. But alas! no steamer was there. Leaving most of the sailors in ambush, I crept up the street with the negro guide and two of my officers, soon reaching a large house with a southern veranda—the general's residence.

It was directly opposite the barracks in which twelve hundred men were sleeping and not fifty feet from them. Gaining the door I opened it and proceeded to explore, finding first a mess room, then some stairs up which I made my way. Lighting a match at the top I saw some doors and had just opened one of them when I heard a crash below and my officers' voices saying, "Captain! captain!" Down I went and opened a door below, striking a wax match at the same time and by the flash I saw a man in dishabille with a chair in hand as if to strike. Dashing

in at once I had him on his back in an instant with the muzzle of a revolver at his temple and my hand on his throat. I doubted not but that my prize was the dignitary sought. Threatening to kill him if he spoke, I struck another match and lit the candle. I then found that it was the chief engineer of the defences that I had and that the general was away in Wilmington. Besides this misfortune the adjutant-general had just escaped from the house. It seems that his bed was close to the window and hearing a noise he arose and looked out. The first sight that met his eye was the muzzle of a navy revolver about two inches from his nose. Down went the window with a crash and the fearfully demoralized officer, wrenching his arm through, dashed out of the back door in garments hardly fitted for display. It was a good joke but not exactly the time for me to laugh at it as I knew that soldiers would swarm out like angry bees in a minute. So I hurried my prisoner into his most necessary garments, pocketed the papers of the absconding adjutant and hastened down to my boat. The town was alive by this time, but like the old gent with the spectacles on his forehead, looking everywhere but in the right place.

I shoved off with officer and contrabands and was nearly down to Fort Caswell before the signal lights told the sentinel forts that Yankee boats were in the harbor, and while the long roll was beating there, and the "butternuts" rushing to their guns, I quietly pulled through the opening and off to my ship.

It was 12 o'clock at night when I entered the headquarters and moonlight; at one I was in my cabin, had given my rebel dry socks and a glass of sherry, laughed at him and put him to bed.

The next morning, to the astonishment of the senior officer, I took my guest off to breakfast and requested permission to send in a flag of truce for his clothes and some money. My boat was permitted to land on the beach and the officer whom I sent in was met as he went ashore by Colonel Jones, the Commander of Fort Caswell. My officer's name was Jones also, and he had been with me the night before. Both of these gentlemen were on their extreme dignity, the colonel saying that he would telegraph up to Smithville and see if he could receive the flag of truce.

They walked up and down the beach in silence and passed each other several times, when the rebel wheeled sharply and suddenly

round and exclaimed: "That was a d—d splendid affair, sir." This broke the ice, and a chat ensued, soon joined in by the adjutant-general with arm in a sling and limping from the effects of his impromptu promenade of the night before. My prisoner's clothes were sent for, and bacon and hard tack with which to regale their guest. A letter was now produced which I sent in for the general. It read as follows:

MY DEAR GENERAL: I deeply regret that you were not at home when I called. I enclose my card.

Very respectfully,
W. B. CUSHING.

This was unanimously declared the essence of impudence but did not prevent them from sending me off the latest papers. They could not guess where I entered or escaped from the harbor as they said that thousands of eyes watched every square inch of it. The next day I started for Beaufort to coal and early in the morning ran into and sunk the U. S. S. *Peterhoff*, formerly the famous blockade runner. It was an unavoidable accident, arising from the strict rules of the blockade that required instantaneous signals in order to avoid being fired into or run down. My false stem was carried away and we proceeded to Norfolk for repairs.

Returning to my coaling station at Beaufort in the month of June, we heard that the rebel iron-clad *Raleigh* had been out amongst our fleet at Wilmington, escorting some blockade runners at night and remaining out until morning. Why she was not attacked I do not to this day know, but as soon as we heard the news Lieutenant-Commander Braine in the *Vicksburg* and myself in the *Monticello* started down the coast determined to ram her in company upon sight. In case she were inside I made out a written application and plan to take her by boarding in the harbor. I sent a copy of this to Admiral Lee at Hampton Roads and took the other down to submit it to the senior officer. As usual, no one would take responsibility excepting myself. I argued that the noses of the squadron had virtually been pulled and begged permission to go in, promising not to come out alive if I failed. It was of no use.

Captain Sands declined to give me the men and it was not until some time after that I received a letter from Admiral Lee "heartily approving" my course and permitting me to call upon

the senior officer for such men and boats as I desired. It was disgraceful to delay it an hour! On the night of June twenty-fifth with fifteen men and two officers,* Howorth and Martin, I ran by Forts Caswell, Holmes and the outer batteries guarding the harbor. With muffled oars we proceeded up the stream, keeping a bright lookout for the iron-clad and for the guard boats. In passing the town of Smithville I was nearly run down by a tug but passed on unsuspected. I was determined to find the *Raleigh* and having ascertained her berth go out and bring back a hundred men to take her.

Not finding the object of our search at the anchorage inside either bar or at the quarantine, I continued on up the river. The moon was shining brightly on our side as we came up abreast of Fort Anderson and suddenly the sentry's hail came across the water, "Boat ahoy!" The cry was repeated by a dozen voices and followed by the fire of musketry. It was too near daylight to make my way out, if I desired it (and I did not) so I determined upon a bit of strategy.

Instantly turning the boat I let them see her in the moonlight, apparently pulling rapidly down stream, then giving her a sheer with the helm I cut off the moon's rays from their line of sight and my boat was invisible in the swell. In this manner I gained the shadow of the opposite bank and under its cover pulled straight up toward Wilmington, leaving them to send their boats and alarm *down* the river.

Thus I passed safely by fort and obstructions, continuing on until within four miles of the city, when as it was almost daylight I prepared for concealment.

We landed and hauled the boat, by great effort, over a strip of sand into some swamp grass, concealing it within branches of trees, after which we stowed ourselves away in the bushes on the bank close to the channel and in a fine position to see all movements of vessels in the river. Eight steamers passed us during the day, amongst them the *Yadkin*, flagship of the rebel Commodore Lynch, but no iron-clad appeared. Just at dark two boats came close in around a point of marsh and looked like an attacking party, so with my men all ready behind a log, I walked

* This expedition left the *Monticello* 8.10 p. m. June 23, and Cushing's official report states that Howorth and J. E. Jones were the two officers who accompanied him.—C. W. S.

out and hailed them, ordering them to surrender. This they did, but proved to be a fishing party of white men from Wilmington. From them I learned that the *Raleigh* had run upon a bar at high water and that as the tide fell the weight of armor had caused her to split open. She was under water. My next thought was to learn all that was possible about the batteries, roads and obstructions, as I knew that our government soon intended a movement on so important and troublesome a place. Taking the fishermen as guides we moved up to the city, examining everything and discovered the nature of the channel obstructions. Pulling down again we went into a creek about four miles below the town and made our way through a cypress swamp to a road which we started off to explore. Finding the main turnpike and telegraph two miles off I hastened to station myself with eight men at the junction of it with two other roads, leaving the rest of the men in ambush near our boat. We were now just outside of the rebel city in the midst of swarms of soldiers and lines of fortifications and it was policy to keep very quiet, but we were growing hungry and a little cross and did not long suffer people to pass unmolested. The first man captured was a hunter who proved to be keeper of a store a mile away, the next was the army mail carrier with a bag of four hundred letters and documents which were eagerly overhauled, discovering the plan and strength of the defenses and number of men in rebel garrisons.

The next thing to be thought of was food. Those who fight must eat and our hard-tack and salt-horse had long since disappeared. Mr. Howorth was, therefore, dressed in the hat and jacket of the Georgia cavalryman, mounted upon his horse and started off to the store of our captured friend, with a pocket full of Confederate money taken from the mail, and the "brass" requisite for his dangerous adventure.

This gallant officer returned safely after mingling freely with soldiers and having to spin a long yarn to an inquisitive female who had a brother in the place which he named as his home. The chickens and milk that he brought back were excellent and had only been obtained by a free use of the storekeeper's name, whom he declared he had met hunting down the road and who had expressly told him to say to Lizzy that I tell her to sell 'em. These articles with the blackberries growing near us formed a meal that could not be improved in Seceshia and left us ready for

anything. Although we permitted most people to pass unmolested, there were some whom it was policy to take and in the afternoon I found my eight men guarding twenty-six prisoners, any one of whom with pluck enough to shout might bring down upon us a swarm of "chivalry." This was becoming too much like the Irishman's tartar and I concluded only to wait for the courier from the city for the evening papers and Richmond news before making for the boat. Mounting a horse I posted myself like a highwayman by the roadside and awaited his coming, but concluded in the meantime to send my prisoners under guard down to the swamp. This move was unfortunate for just as they filed across the road into the woods my expected mail carrier came over a knoll, two hundred yards away, with another mounted man in company. Seeing the blue shirts and carbines they knew at once what had become of the morning courier and instantly wheeled about. I pursued, but to no purpose, my cavalry brigade was tired and soon distanced. I now, for the first time, cut the wires to prevent them from sending a message to Fort Fisher and made for the boat with all speed, placed my prisoners in canoes, took them in tow and moved down toward the river which we entered at dusk.

I now determined to place the most of the captured men in the lighthouse on Marsh Island which had no keeper, and then escape before the pursuit should become too hot to permit it, but just as I neared it the steamer *Virginia* rounded the point and came right at us. I instantly ordered the men to jump overboard and shove the boats in close to the marsh grass, holding their heads below the gunwale and threatened any prisoner who spoke with immediate death. In the dark our ruse succeeded, the steamer passed within ten feet of us and failed to discover their Yankee visitors.

I now took away the oars and sails from the canoes and set twenty men adrift in the tideway, knowing that they would be picked up in the morning, and also made fast a note to a buoy, reminding Colonel Jones of his boast that I would never enter the harbor again. We had now to get down by Fort Anderson, Fort Fisher, the forts on Zeek's Island, and batteries, Campbell and the Mound, and it was quite certain that their boats would be ready to intercept us at the bar. Passing Anderson undiscovered we captured a boatload of soldiers and were informed that there

was a guard-boat out, containing seventy-five musketeers waiting for us. The tide was now in our favor and I concluded to pull boldly for the bar, run foul of the guard-boat, use cutlasses and revolvers and drift by the batteries in that way since they would not fire on their own men. It was within an hour of daylight and everything was as bright in the moon's rays as if dawn were, indeed, come. As we neared Confederate Point a boat was seen rising and falling with the swell and our course was at once shaped for it. My men were eager to commence so unequal a fight, feeling confidence in themselves, in an encounter with five times their number of soldiers on the water. My orders were to wait for my word and *then* all but the two bow oars "trail" and take to their arms while I sheered in and laid our boat aboard. The eight rebel soldiers with us I promised immediate death upon the least sign that they would aid their comrades.

When some fifteen yards from the object of attack I ordered those not pulling to aim and was about to pour in a broadside when four more boats shot out from Confederate Point and five from Zeek's Island, pulling so as to form a line across the whole entrance. At the first glimpse I saw the trap and formed the only plan that hope left me. With helm hard aport we went short around but only to find a large boat to windward under canvas. We were now at the junction of the two channels where the tide splits, one leading down seven miles below to Caswell, where I had entered, and the other where I proposed to go out. At the Caswell entrance a southwest gale had been blowing and it was no doubt breaking clear across the bar; besides it would be daylight ere we could have passed Smithville or the forts, so our only chance was at Fisher. Dashing off with the tide in the direction of Smithville, I passed the sail boat, and by my trick of sheering the cutter so as to avoid reflecting the moon's rays, caused the enemy's main line of boats to lose sight of her in the swell.

Being soldiers they did not take into consideration the facts regarding the impossibility of escape at the west bar and concluded that I was making for it. The whole line came after in pursuit, leaving their original station unguarded. That was my time and it was improved. Suddenly turning we approached the sail boat as if to board, when her crew lost their nerve and tried to tack. Missing stays they drifted off with the tide, while we shot around in a semi-circle and cut under the stem of the line of boats in chase.

Then they saw us but too late. We gained the channel a hundred yards the start of the leading boat and to prevent being blown out of water by the forts, plunged boldly into the breakers upon Caroline Shoal and went through safely, the army boats not daring to follow. In this expedition I did not sleep for sixty-eight hours.

For this as for my previous visit to the harbor I received the official thanks of the Navy Department.

About this time the Government was laboring under much anxiety in regard to the condition of affairs in the sounds of North Carolina. Some months previous a rebel iron-clad had made her appearance attacking Plymouth, beating our fleet, sinking the *Southfield* and killing Captain Flusser, who commanded the flotilla. General Wessel's brigade was forced to surrender and all that section of country and line of Roanoke River fell into rebel hands.

The "Little Washington" and the "Tar River" were thus outflanked and lost to us. Some time after, this iron-clad, the *Albemarle,* steamed out into the open sound and engaged nine of our steamers, doing much damage and suffering little. The *Sassacus* attempted to run her down but failed and had her boiler exploded by one of the two hundred-pounder shell fired from the Confederate. The Government had no iron-clad that could cross Hatteras bar and enter the sounds, and it seemed likely that our wooden ships would be defeated, leaving Newbern, Roanoke Island and other points endangered. At all events it was impossible for any number of our vessels to injure her at Plymouth and the expense of our squadron kept to watch her was very great. At this stage of affairs Admiral S. P. Lee was speaking to me of the case when I proposed a plan for her capture or destruction. I submitted, in writing, two plans either of which I was willing to undertake.

The first was based upon the fact that through a thick swamp the iron-clad might be approached to within a few hundred yards. India rubber boats to be inflated and carried upon men's backs might be procured and transported by a boarding party of a hundred men, or two low-pressure and very small steamers, each armed with a torpedo and howitzer, might constitute the offensive force. In this last named plan (which had my preference) I intended that one boat should dash in while the other stood by to

throw canister and renew the attempt if the first failed. It would also be useful to pick up our men if the attacking boat were disabled. Admiral Lee believed that the plan was good and ordered me to Washington to submit it to the Secretary of the Navy. Mr. Fox doubted the merit of the affair, but concluded to order me to New York to purchase suitable vessels. Finding some boats building for picket duty, I selected two and proceeded to fit them out. They were open launches about thirty feet in length with small engines and propelled by a screw. A twelve-pounder howitzer was fitted to the bows of each and a broom rigged out, some fourteen feet in length, swinging by a goose-neck hinge to the bluff of the bow. A topping lift to a stanchion inboard raised or lowered it and the torpedo was fitted into an iron slide at the end. This was intended to be detached from the boom by means of a heel jigger leading inboard and exploded by another line connecting with a pin which held a grape shot over nipple and cap.

The torpedo was, I believe, the invention of Engineer Lay of the Navy and introduced by Chief Engineer Wood. It has many defects and I would not again attempt its use. Everything being complete we started to the southward, taking the boats through the canals to Chesapeake Bay and losing one in going down to Norfolk. This was a great misfortune and I have never understood how so stupid a thing occurred. I forget the name of the volunteer ensign to whose care it was entrusted, but am pleased to know that he was taken prisoner. I trust that his bed was not of down or his food that of princes while in rebel hands.

My best boat being thus lost I proceeded with one alone to make my way through the Chesapeake and Albemarle Canal into the sounds. Half way through the canal was filled up, but finding a small creek that emptied into it below the obstruction I endeavored to feel my way through. Encountering a mill dam, we waited for high water and ran the launch over it. Below she grounded but I got a flat boat and, taking out gun and coal, succeeded in two days in getting her through.

Passing with but seven men through the canal where for thirty miles there was no guard or union inhabitant, I reached the sound and ran before a gale of wind to Roanoke Island. Here I pretended that we were going to Beaufort and engaged to take two passengers along. This deception became necessary in con-

CONFEDERATE STATES IRON-CLAD RAM ALBEMARLE.

sequence of the close proximity of the rebel forces. If any person had known our destination the news would have reached Plymouth before we arrived to confirm it.

So in the middle of the night I steamed off into the darkness and in the morning was out of sight.

Fifty miles up the sound I found the fleet anchored off the mouth of the river and awaiting the ram's appearance. Here I, for the first time, disclosed to my officers and men our object and told them that they were at liberty to go or not as they pleased. These, seven in number, all volunteered. One of them was Mr. Howorth, of the *Monticello,* who had been with me repeatedly in expeditions of peril. The names of all who went with me I give in conclusion. Six were added to my original force. Amongst these was Assistant Paymaster Frank Swan, who came to me as we were about to start and urged that he might go, as he had never been in a fight. Disregarding my remark that it was a bad time for initiation he still made the request and joined us. He found an eventful night of it, being wounded and spending his next four months in Libby Prison and Salisbury.

The Roanoke River is a stream averaging one hundred and fifty yards in width and quite deep. Eight miles from the mouth was the town of Plymouth, where the ram was moored. Several thousand soldiers occupied town and forts and held both banks of the stream.

A mile below the ram was the wreck of the *Southfield* with hurricane deck above water and on this a guard was stationed to give notice of anything suspicious or fire rockets in case of attack. Thus it seemed impossible to surprise them or to attack with hope of success. Impossibilities are for the timid: we determined to overcome all obstacles. On the night of the twenty-seventh of October we entered the river, taking in tow a small cutter with a few men, the duty of which was to dash aboard the *Southfield* at the first hail and prevent any rocket from being ignited.

Fortune was with our little boat and we actually passed within thirty feet of the pickets without discovery, and neared the wharf where the rebels lay all unconscious. I now thought that it might be better to board and "take her alive," having in the two boats twenty men well armed with revolvers, cutlasses and hand grenades. To be sure there were thousands near by and ten times

our number on the ship, but a surprise is everything and I thought that if her fasts were cut at the instant of boarding we might overcome those on board, take her into the stream and use her iron sides to protect us after, from the forts. Knowing the town I concluded to land at the lower wharf, creep around and suddenly dash aboard from the bank, but just as I was sheering in close to the wharf a hail came sharp and quick from the iron-clad, in an instant repeated. I at once directed the cutter to cast off and go down to capture the guard left in our rear, and ordering all steam, went at the dark mountain of iron in front of us. A heavy fire was at once opened upon us, not only from the ship, but from men stationed on the shore, but this did not disable us and we neared them rapidly. A large fire now blazed up on the bank and by its light I discovered the unfortunate fact that there was a circle of logs around the *Albemarle,* boomed well out from her side, with the very intention of preventing the action of torpedoes.

To examine them more closely I ran alongside until amidship, received their fire and sheered off, for the purpose of turning, a hundred yards away and going at the booms squarely. This was my only chance of success and even if my boat were forced over the obstruction it could never get out again. But I was there to accomplish an important object and to die if needs be was but a duty. As I turned the whole back of my coat was torn out by buck shot and the sole of my shoe was carried away. The fire was very severe. In a lull of the firing the captain hailed us, again demanding what boat it was. All my men gave some comical answer and mine was a dose of canister which I sent amongst them from the howitzer, buzzing and singing against the iron ribs and into the mass of men standing fire-lit upon the shore .

In another instant we had struck the logs and were over, with headway nearly gone, slowly forging up under the enemy's quarter port. Ten feet from us the muzzle of a rifle gun looked into our faces and every word of command on board was distinctly heard.

Four more bullets now ploughed through my clothing in quick succession as I stood in the bow, the heel jigger in right hand and exploding line in left.

We were near enough then and I ordered the boom lowered until the forward motion of the launch carried the torpedo under

the ram's overhang. A strong pull of the detaching line, a moment's waiting for the torpedo to rise under the hull, and I hauled in the left hand just cut by a bullet. The explosion took place at the same instant that one hundred pounds of grape at ten-feet range crashed in our midst and the dense mass of water thrown out by the torpedo came down with choking weight upon us. Twice refusing to surrender, I commanded the men to save themselves and throwing off sword, revolver, shoes and coat, struck out from my disabled and sinking boat into the river. It was cold, long after the frosts and the water chilled the blood while the whole surface of the stream was ploughed up by grape and musketry and my nearest friend was twelve miles away, but anything was better than to fall into rebel hands.

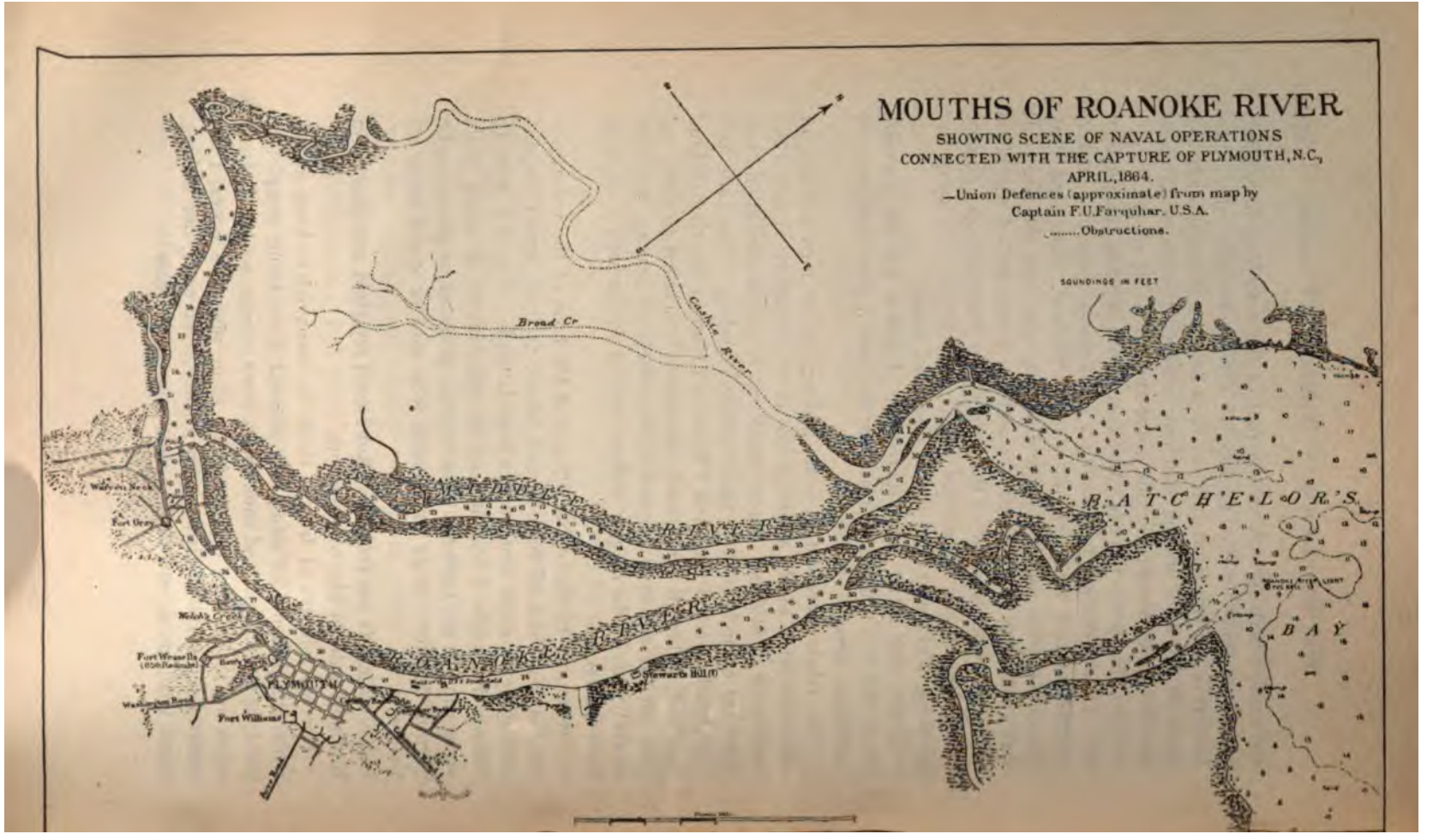
Death was better than surrender. I swam for the opposite shore, but as I neared it a man near me gave a great gurgling yell and went down.

The rebels were out in boats picking up my men and one of these attracted by the sound pulled in my direction. I heard my own name mentioned. I now struck out down the stream and was soon far enough away to again attempt landing. This time as I struggled to reach the bank I heard a groan in the river behind me, and, although very much exhausted, concluded to turn and give all the aid in my power to the officer or seaman who had bravely shared the danger with me and in whose peril I might in turn partake.

Swimming in the night with eye at the level of the water, one can have no idea of distance and labors, as I did, under the discouraging thought that no headway is made. But if I were to drown that night I had at least an opportunity of dying while struggling to aid another. Nearing the swimmer he proved to be Acting Master's Mate Woodman, who said he could swim no longer.

Knocking his cap from his head I used my right arm to sustain him and ordered him to strike out.

For ten minutes at least I think he managed to keep afloat, when his presence of mind and physical force being completely gone, he gave a yell and sank like a stone, fortunately not seizing upon me as he went down. Again alone upon the water, I directed my course toward the town side of the river, not making much headway as my strokes were now very feeble.


MOUTHS OF ROANOKE RIVER
SHOWING SCENE OF NAVAL OPERATIONS
CONNECTED WITH THE CAPTURE OF PLYMOUTH, N.C.,
APRIL, 1864.
—Union Defences (approximate) from map by
Captain F.U. Farquhar. U.S.A.
.....Obstructions.
SOUNDINGS IN FEET
Broad Cr
Conaho River
ROANOKE RIVER
BATCHELOR'S
BAY
Fort Grey
Nicholl's Creek
Fort Wessells
PLYMOUTH
Fort Williams
Stewarts Hill (f)

My clothes were soaked and heavy and little chop seas splashed with a choking persistence into my mouth every time I gasped for breath. Still there was a determination *not* to sink, a will *not* to give up, and I kept up a sort of mechanical motion long after my bodily force was in fact expended.

At last, and not a moment too soon, I touched the soft mud and in the excitement of the first shock I half raised my body and made one step forward, then fell and remained half in the mud and half in the water until the daylight, unable even to crawl on hands and knees, with brain in a whirl and nearly frozen but with one thing strong in me, the fixed determination to escape. The prospect of drowning, starvation, death in the swamps, all seemed lesser evils than that of surrender. As day dawned I found myself in a point of swamp that enters the suburbs of Plymouth and not forty yards from one of the forts. The sun came out bright and warm, proving a most cheering visitant and giving me back a great portion of the strength of which I had been deprived before.

Its light showed me the town, swarming with soldiers and sailors, who moved about in an excited manner as if angry at some sudden shock. It was a source of satisfaction to me to know that I had pulled the wire that set all these figures moving in a manner quite as interesting as the best of the theatricals, but as I had no desire to be discovered by any of the dogs that were so plentiful around me, I did not long remain a spectator.

My first object was to get into a dry fringe of rushes that edge the swamp but to do this required me to pass over thirty or forty feet of open ground right under the eye of the sentinel who walked the parapet. Watching, until he turned for a moment, I made a dash to cross the space, but was only halfway over when he turned and forced me to drop down right between two paths and almost entirely unshielded.

Perhaps I was unobserved because of the mud that covered me and made me blend in with the earth. At all events the soldier continued his tramp for some time while I, flat on my back, waited another chance for action. Soon a party of four men came down the path at my right, two of them being officers, and passed me so close as to almost tread upon my arm. They were conversing about the events of the previous night and wondering how it was done, entirely unconscious of the presence of one who could give them the information. This proved to me the necessity of re-

gaining the swamp, which I did by sinking my heels and elbows into the earth and forcing my body inch by inch toward it. For five hours then, with bare feet, head and hands, I made my way, where I venture to say none ever did before, until I came at last to a clear place where I might rest upon solid ground. The cypress swamp was a network of thorns and briers that cut into the flesh at every step like knives and frequently when the soft mire would not bear my weight I was forced to throw my body upon it at length and haul along by my arms. Hands and feet were raw when I reached the clearing and yet my difficulties were but commenced. A working party of soldiers was in the opening engaged in sinking some schooners in the river to obstruct the channel. I passed twenty yards in their rear through a corn furrow and gained some woods below. Here I encountered a negro and after serving out to him twenty dollars in greenbacks and some texts of Scripture (two powerful arguments with an *old* darkey), I had confidence enough in his fidelity to send him into town for news of the ram. When he returned and there was no longer doubt that she had gone down, I went on again with a light heart and again plunged into a swamp so thick that I only had the sun for a guide and could not see ten feet in advance. About 2 in the afternoon I came out from the dense mass of weeds upon the bank of one of the deep, narrow streams that abound there and right opposite to the only road in that vicinity.

It seemed Providential that I should come just there for thirty yards above or below and I never would have seen it and might have struggled on until worn out and starved and found a never-to-be-discovered grave. As it was my fortune had led me to where a picket party of seven soldiers were posted, having a little flat bottomed, square-ended skiff, toggled to the root of a cypress tree that squirmed like a snake into the inky water. Watching them until they went back a few yards to eat, I crept into the stream and swam over, keeping the big tree between myself and them and making for the skiff.

Gaining the bank I quietly cast loose the boat and floated behind it some thirty yards, around the first bend, where I got in and paddled away as only a man could where liberty was at stake. Hour after hour I paddled, never ceasing for a moment, first on one side then on the other, while sunshine passed into twilight and that was swallowed up in thick darkness only relieved by the

few faint star rays that penetrated the heavy swamp curtain on either side.

At last I reached the mouth of the Roanoke and found the open sound before me.

My frail boat would not have lived a moment in the ordinary sea there, but it chanced to be very calm, leaving only a slight swell which was, however, sufficient to influence my boat so that I was forced to paddle all upon one side to keep her on the intended course. After steering by a star for where I thought the fleet might be for, perhaps, two hours I at length discovered one of the vessels and after a long time got within hail.

My "Ship ahoy!" was given with the last of my strength, and I fell powerless with a splash into the water in the bottom of my boat and awaited results. I had paddled every minute for twelve successive hours and for four my body had been "asleep" with the exception of my two arms and brain.

The picket vessel *Valley City*, for it was she, upon hearing the hail at once slipped her cable and got under way at the same time lowering boats and taking precaution against torpedoes. It was some time before they would pick me up, being convinced that I was a rebel conductor of an infernal machine, and that Lieutenant Cushing had died the night before.

At last I was on board, had imbibed a little brandy and water, and was on my way to the flag ship commanded by Commander Macomb.

As soon as it became known that I had returned, rockets were thrown up and all hands called to cheer ship and when I announced my success, all the commanding officers were summoned on board to deliberate upon a plan of attack. In the morning I was again well in every way with the exception of hands and feet and had the pleasure of exchanging shots with the batteries that I had inspected on the day previous.

I was sent in the *Valley City* to report to Admiral Porter at Hampton Roads and soon after Plymouth and the whole district of the Albemarle, deprived of the iron-clad's protection, fell an easy prey to Captain Macomb and our fleet. I again received the congratulations of the Navy Department and the Thanks of the Congress of the United States. I was also promoted to the grade of lieutenant-commander. The testimonials that I received from the Chamber of Commerce, cities, Union League Clubs, etc., were

numerous and gratifying. I was at this time twenty-one years of age, having had my first command at nineteen. The *Albemarle* was built like the famous *Merrimack* and in her contests with our ships successfully resisted solid hundred-pounder Dahlgren and Parrott shot at ten yards' range.

In November, 1864, I assumed command of the flagship *Malvern* bearing the broad pennant of Rear-Admiral David D. Porter. A large fleet was collected in Hampton Roads and it was known that Wilmington was the point of attack.

UNITED STATES FLAGSTEAMER MALVERN.

A combined army and navy movement was made against Fort Fisher in December and resulted in a failure, in consequence of the generalship of General B. F. Butler, who would not assault, after a bombardment from the ships that kept the weak and surprised garrison so effectually in their bomb-proofs that their flag was taken openly down the beach in the broad sunlight.

The indignation of army and navy at this inexcusable conduct of Butler's was openly and loudly expressed and we all rejoiced when another attack was ordered under a man who would not permit great egotism and a jealous temper to make him blind to his duty as a soldier. In the first attack I took my gig and went

in on the bar to sound and put down buoys. I was six hours upon this dangerous duty and congratulate myself that we were not blown out of water. Round shot, shell and shrapnel ploughed around us every moment, and I actually had to bail out the water that was thrown into the boat by them. A cutter assisting us was sunk by the severe fire.

There is no doubt that this was the most dangerous service rendered during the day. This was the scene of the famous Powder Boat Explosion. I was sounded in Washington by Mr. Fox as to my willingness to perform the service of firing the powder and at once consented to do so as I had, early in the war, to the taking in of a powder ship to Sumter for the same purpose. But afterward Commander Rhind was placed in command of the expedition which failed from no fault of his. The day after the withdrawal of the troops a volunteer lieutenant, commanding an armed prize, came around from the Western Bar and reported that he had been chased away by a rebel privateer loaded down with men and protected by cotton bales. The admiral at once sent for me and did me the honor to propose that I should capture her, giving me again command of my old favorite, the *Monticello*, for that purpose. Steaming around the shoal as rapidly as possible, I found the vessel described at anchor inside the bar under the guns of Fort Caswell and fired a blank cartridge as a challenge. This did not draw her out, nor did the subsequent destruction of a large blockade-running steamer which I drove ashore under the batteries in her attempt to get in. In this service my ship was hulled six times. The *Chickamauga* would not fight, probably suspecting some Yankee trap, whereas, nothing was desired by us but a fair field and no favor. With her extra men aboard she was much the stronger and might better have finished her career in a gallant action on the ocean than in the way she did, sunk by a retreating crew in Cape Fear River.

On the twelfth of January everything being ready the attack was resumed against the forts of Wilmington. These mounted nearly a hundred heavy guns and, warned by Butler's fiasco, were garrisoned by over three thousand veteran soldiers. The ships, sixty in number, advanced in beautiful order, the iron-clads taking the lead and followed by the heavy frigates, after which in turn came sloops of war and gunboats. The fire from the fleet was terrific and soon drove the enemy into shelter. For three days

the bombardment continued, in which time most of the opposing guns were disabled and the time came for assault. On the morning of the fifteenth, the admiral observing the *Chickamauga* and some other steamers maneuvering to reinforce the forts inside, ordered me to drive them away. In order to do this I ran my wooden vessel inside of the iron-clad line and all other ships nearest to Fort Fisher, where I moored head and stern and opened fire upon the steamers with my one-hundred pounder Parrott and with broadside guns upon the fort. After driving these vessels from position the fire was continued upon the embrasures.

About 2 in the afternoon, I landed with forty men to join the assaulting body of sailors and marines who were to storm the sea front of the fort. These were fourteen hundred in number, the officers all in uniform, bright with gold lace and every man dressed as for inspection. All were armed with cutlass and revolver alone, excepting the marines, who carried muskets and were to cover us in scaling work.

Wheeling from column into line, we marched up by the flank to within four hundred yards of the frowning fort and lay down under the slope of sand beach until the signal for assault should come from the army, who were to advance from the other side.

Lieutenant Ben Porter and myself massed our men and agreed to lead the assault, bearing with us the admiral's blue flag. In the meantime, while we waited, the whole fire of the navy passed a few feet over our heads. Such a hell of noise I never expect to hear again. Hundreds of shell were in the air at once, varying from the five hundred-pounders of the iron-clad to those of a half and fourth of that weight, but all shrieking in a grand martial chorus that was a fitting accompaniment to the death dance of the hundreds about to fall. At last the signal came and we were up in an instant, advancing steadily, until within a hundred yards and then bursting forward with a cheer from the whole line.

The beach to be gone over was level white sand into which we sank, ankle deep, and which in the bright sunlight made targets of us all from contrast. The rebels, meanwhile, were not idle, but thinking ours the main storming party, massed against us and sent a staggering fire into our ranks that ploughed through with deadly effect and never ceased for an instant. We gained the palisades only to find further advance impossible and all were

brought to a halt. Thinking that I saw an opening I sprang forward and had proceeded some distance when upon looking behind me I perceived that I was not followed, so I went down in the sand for shelter.

In a moment I heard the voice of one of my men crying out, "Captain Cushing! They are retreating, sir!" and upon looking around I saw the whole line breaking and going backward. A hundred yards was now between myself and the retreating force, and I was close under the muzzle of the Confederate rifles, but I made up my mind that it was my duty to join my men and rally them, so I sprang to my feet amidst what can only be called a storm of bullets and passed unharmed to our force. That retreat was a fearful sight. The dead lay thickly strewn along the beach, and the wounded falling constantly called for help to their comrades and prayed to God that they might not be left behind. I saw the wounded stagger to their feet all weak and bloody, only to receive other and more fatal wounds, and fall to rise no more. Our attempt had the good result of diverting the rebel attention from the army who surprised their rear and gained a hold upon their traverses, a seizure that was gradually increased until all was in our possession. Noble Ben Porter had met his death early in our assault as well as Lieutenant Preston and many of the officers had remained under the palisades of the fort until it should be dark. Amongst these were most of the ranking officers, including Fleet Captain Breese, who commanded the attack. I, therefore, assumed command and after intense exertion and fatigue succeeded in collecting a few hundred men with whom I again proceeded to assault when I was met by an aid of General Terry, who requested me to place my men in the intrenchments in front of Bragg's army that was about to attack us from the rear.

This I did, relieving a regiment which went in fresh to General Terry's assistance. At 10 that night the entire rebel force surrendered. In the intermediate time, between the assault and the surrender, the tide had risen and drowned many of our wounded who fell upon the beach and swept off into the remorseless ocean the hero clay of many a gallant sailor. How few realize at what a cost our nation's unity has been purchased! On the 16th I was ordered around to the West Bar on a reconnoissance of the forts there. Anchoring my ship, I pulled in with five men and an officer in my gig to demand the surrender of Fort Caswell. Finding it

abandoned I hoisted the American flag and proceeded to take possession of several other batteries in the vicinity. Pushing on up to Smithville, I received the surrender of the town from the mayor and hoisted our flag on the fort, capturing there large quantities of arms and provisions.

Rebel cavalry were in the streets but I took possession of a building at the end of the wharf and loading a lot of muskets remained there with four men while I sent away two sailors with darkey boats' crews, one out of my ship, for reinforcements, and the other up through the river to Fisher to notify the admiral. That night I had two hundred sailors ashore and established myself as military governor. Our first act was to seize the men who had piloted blockade runners over the bar. These I promised to hang but finally concluded to spare them if they hoisted upon Oak Island the signal lights by which ships ran in and out.

My threat had its effect and the lights were stationed while I prepared boats for boarding any such vessels as might be decoyed into our trap.

On the night of the twentieth a large steamer came over the bar and made the private signals to Fort Caswell. Of course these could not be answered, but my officer as directed hailed her and said that all was right, that the signal corps was withdrawn to Smithville. Upon this she came up and anchored.

When we boarded and informed the captain that his vessel was a prize, he was not the only one astonished. A champagne supper was in progress in honor of successfully running the blockade at which several English army officers were making merry, confident that they were in the friendly and hospitable bosom of the Southern Confederacy.

As we sat down amongst them and ordered the steward to bring another case of champagne, their tongues loosened and one in accents of English disgust, exclaimed, "Beastly luck!" "A most unmitigated sell!" responded number two.

Aye, gentlemen, and may you never meet better luck on the same errand! This was the steamer *Charlotte*, loaded with arms and machinery, and reported one of the fastest in the trade. Ten minutes later the Confederate steamer *Stag* came in, loaded down with a valuable cargo and was captured in the same manner. But, while the plan and credit of success were all mine, it was not so with the prize money. The *Malvern* and several light ves-

sels came down that very evening and being within signal distance were entitled to claim equal shares with us.

On the night of the fifth of February, with fifty men in three boats, I entered Little River, the same place where I previously stormed the battery, and proceeded with muffled oars to the small town of All Saints Parish, South Carolina. Landing in the fog and taking a negro for a guide I soon had all the houses under guard without the knowledge of a single one of the inhabitants. Proceeding to a Confederate cotton storehouse I seized the contents.

In the morning the good townspeople were considerably astonished to find a blue jacket and musket at every door. As no one escaped we remained there quietly all day, enjoying the poultry and sweet potatoes that South Carolina furnished and capturing such mails and soldiers as came along.

At night we drew off with our prizes without an attack from any of the bodies of soldiers in the immediate vicinity. Knowing that the news of our visit would draw forces from the inlets near by, we organized an expedition for the capture of a Confederate storehouse three miles back of Shallotte Inlet.

Here were collected corn and bacon for the Confederate forces at Wilmington. We surprised and captured it with fifty men, taking prisoners eight of the guard, and burning everything that could not be brought away in captured carts.

I now left the *Monticello* outside of Cape Fear River and went on board the flagship *Malvern* near Fort Anderson, which the navy was about to attack.

Here, several nights in succession, I went up close under the guns of the rebel fort, to examine the obstructions and torpedoes and once pulled with my brother, Paymaster Cushing, in company close up to the city. One night while I was on this duty I found a band of music playing in Anderson and speeches being made by enthusiastic Confederates who were picturing in glowing terms the victories of the chivalrous South and heaping whole continents of scorn upon the base and cowardly North.

The Confederacy was about to tumble but they were blind to the fact. Their armies were all beaten but one southerner was still the sure conqueror of five Yankees. It was bright moonlight and I enjoyed the music in which the bombast was sandwiched exceedingly, but at length could not resist the temptation

of sending a bullet amongst the crowd as a period to the speech making, at the same time consigning them with a shout to a place somewhat warmer than Dixie. I succeeded in astonishing them, but the way the grape shot flew around for a while from their guns was far from pleasant. Their discipline was evidently good. Every night that I went up after this I carried on my observations to the music of rebel round shot, but night firing is very inaccurate and their ammunition was wasted.

REAR-ADMIRAL PORTER AND STAFF ON THE U. S. S. " MALVERN," DECEMBER, 1864.

Cushing, commanding the *Malvern,* is at extreme left of picture with cape folded on his right arm.

In consequence of a formidable line of obstructions, and a quantity of torpedoes in front of this fort, it was decided unsafe to attempt running the fleet by its guns, and until that *should* be done it had free communication with the city above. Our army was closing in upon its rear but could not command the river, and it became necessary for the navy to act. I, therefore, proposed to Admiral Porter the construction of a mock *Monitor,* such as was used by him upon the Mississippi River, and at once proceeded to construct it out of an old flat boat and some canvas. When complete it was not possible to distinguish between it and the real one near by at two hundred yards' distance.

The tide there runs at about five knots speed and it was to be the motive power. Weighting one end of my iron-clad much heavier than the other so as to take it straight up with the tide, I towed her up to within two hundred yards of the opening of the obstructions and cast adrift.

Up the river with the flood tide she went, apparently steaming and in spite of everything passed successfully.

The consequence was that the commanding Confederate, knowing that the army was closing in behind him, and thinking a *Monitor* in the river above, evacuated in such haste as to leave the fourteen heavy guns unspiked and magazine intact.

We took possession the next morning. Confederate officers told me afterward that this was the true reason for their retreat, and swore like pirates at the imposition.

I was soon after ordered up to Norfolk to fit a torpedo upon my ships's bows to encounter the anglo-rebel iron-clads expected from Europe, but after making ready found that I was to be disappointed by their non-appearance.

Just as the bottom of the rebellion fell out at Richmond, I was detached and granted leave of absence.

NOTE.—In the preceding issue of the PROCEEDINGS OF THE U. S. NAVAL INSTITUTE the article entitled "William Barker Cushing" should be read with the following additions or corrections:

The aunt with whom Cushing was visiting in Washington in January, 1861, was his aunt Mrs. Fannie Cushing of whom he was very fond.

Cushing received a slight abrasion of the left hand at the time of sinking the *Albemarle*.

Cushing was born in Delafield, and his sister Isabel was born in Chicago.

Congressman Edwards was not a kinsman of Cushing but a friend who loved him as a son.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CONTROL OF THE SEA: ITS RELATION TO THE RUSSO-JAPANESE WAR.*

By MIDSHIPMAN GEORGE C. MANNING, Class of 1914, U. S. N. A.

Motto: "All depends on the command of the sea."

In spite of the tremendous impression which Admiral Mahan's works about the influence of sea power on history have made upon the minds of the thinking public, many people look upon the late war between Russia and Japan as a war in which the navy counted for little. Although this noted tactician has shown that every war of consequence has been won by that nation which secured control of the sea, and that this victory was the direct result of control of the sea, few see the application of this law in the Russo-Japanese war. Notwithstanding the fact that eminent military and naval critics have expressed an opinion to the contrary, many of us lay the blame of Russia's defeat upon General Kuropatkin. The facts of the matter are that, although the Russian general was undoubtedly a greater strategist than his opponents, he was defeated because of a lack of assistance on the part of the navy.

General Kuropatkin said in a letter to his sovereign that he would gladly assume all the responsibility for his country's defeat, but that this would be historically untrue. In an article in *McClure's* he made the following statement which throws some light on the previous assertion:

> In the war with Japan the chief place belonged to operations on the sea; not to those on the land. If we had smashed the Japanese fleet, the war on Chinese territory would have become an impossibility for the Japanese. As a matter of fact, our fleet helped the land forces very little indeed. Our fleet did nothing to hinder the Japanese from bringing up all sorts of stores, guns, ammunition, and materials.†

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* The medal offered by the Admiral Trenchard Section, No. 73, Navy League of the United States, to midshipmen of the 3d and 4th classes, for the best essay on a topic either naval or patriotic in character, was awarded June Week, 1912, for this essay.

† General Kuropatkin: The Causes of Russia's Defeat by Japan. *McClure's Magazine*, Vol. 32, p. 215.

These are the facts of the case in a nutshell, but they may not be self-evident. We are not willing to grant this importance to the navy without proof. We demand that we be shown. To say that without control of the sea at the beginning of the war Japan would not have been able to attack Russia in Manchuria, is well enough. To maintain that without control of the sea throughout the war Japan would not have been able to prosecute a war, is all right, too. We want proof.

Let us begin with facts that are axiomatic, indisputable. In the first place, Japan is an island, or rather a series of islands. She is separated from China by bodies of water too wide to jump and too deep to wade, across which there are no bridges. If men and munitions of war are to be transferred from Japan to the mainland of Asia, they must be sent on ships. Now, let us assume for the time being that Japan has not unquestioned control of the sea, but that the opposing forces are about evenly matched and that the control has not yet been decided. Vessels conveying soldiers and stores are not armed. Every time one of these ventures out of a Japanese port, unless escorted by the entire fleet, she stands a good chance of being captured by the enemy. Had Russia's fleet in Asiatic waters been able to dispute the control of the sea with Japan, the latter nation would have found it extremely difficult (if not altogether impossible) to transport the men and supplies necessary to maintain such a gigantic struggle as the war between Russia and Japan.

But, of course, such a condition of affairs could not continue long. Let us suppose that in the battle settling the supremacy on the deep the Russian fleet had defeated her antagonist. In other words, let us assume that Russia had had control of the sea and the Japanese war vessels were driven to fortified harbors. Would Japan then have been able to reinforce her armies and furnish them with the necessary munitions of war? If Russia had control of the sea her fleet would be able to blockade the Japanese ports. The only supply vessels that could reach Japan's struggling legions in Manchuria would be such as managed to slip past the blockading squadron. If she had no army in China, it is evident that with her ports blockaded she would not be able to send one there. If she did have an army in Manchuria, she would be unable to send it supplies or reinforcements. This army, unable to retreat and cut off by sea from its base, would be in a very embarrassing position, and compelled to surrender without being able to strike

a blow at the enemy, for without cartridges and food men cannot fight.

But this imaginary state of affairs did not prevail in the east when Japan attacked Russia, or at any time during the war. From February 8, 1904, when Japan struck the first blow until hostilities were closed by the Treaty of Portsmouth, Japan's control of the sea was perfect and complete. There never was a time when there was any doubt who was master of the Japan Sea. It is to this and to this alone that the yellow man owes his tremendous victory over the Russian bear.

Just previous to the opening of hostilities, Russia seemed to be indifferent, careless. Her head men thought it impossible that Japan should declare war against her. Therefore, instead of concentrating the larger part of her naval forces in Asiatic waters, she was content to leave there only her regular Asiatic squadron. It seems impossible, looking at the war to-day, that Russia could have been as blind to the prospects of war as she was. The Japanese were ready for war, looking forward to it. On the 9th of February, 1904, the protected cruiser *Varyag* and the gunboat *Coreetz* saw transports under escort of a powerful squadron of Japanese war vessels unload the nucleus of an army, and a large amount of supplies. These surely were sufficiently warlike preparations to warn them that it was no time for listlessness. Still Captain Togo says of them: * "The Russian ships behaved with the utmost unconcern; their washing was hanging out to dry, and their swinging booms out as if they were wholly indifferent to the great drama about to be enacted. What must have been their amazement when they found we were prepared for action, our gunners coming up on deck with their gloves for loading. Perhaps, however, they did not know what to make of this." Even if the Russian fleet in the Asiatic waters had been equal to that of the Japanese, it would have been defeated just as surely if the officers had made no more preparation for the struggle than they did. To bring a war to a successful termination needs, above everything else, preparation, readiness.

It must be remembered, moreover, that in discussing the relative strength of the Russian and Japanese naval forces in the east, several things must be taken into account which cannot be set down in figures, but which in reality often count for more in winning battles than guns and armor. Any armor is sufficient to

* Captain Togo: Naval Battles of the Russo-Japanese War, p. 7.

protect a ship from shots that never hit. A 6-inch shell that hits does more damage to the enemy than a million 12-inch shells that merely splash the water. Having practically no outlet to the sea the Russians are not sea-going, as are the Japanese, for their life is intimately connected with the sea. The ability of the Japanese sailors was greater than that of the Russian seamen. In all their engagements the little yellow men proved themselves much better marksmen than their opponents. In a word, "the man behind the gun" on the Japanese vessels, was both naturally, and on account of his better training, superior to his adversary on the Russian ships of war. Moreover, the Japanese seemed moved by a consuming love of country, which we cannot help admiring. On the other hand, in too many instances the Russian sailors were not only highly indifferent, but actually anxious to keep out of the fight. Men who fight in a war simply because the czar says so, feeling no personal interest in the matter one way or the other, do not have the same interest, the same eagerness to win that men have who feel that they are fighting their own cause, for their own homes and loved ones. Then, again, the Russians were so over-confident that they did not think it worth while to make tremendous preparations and sacrifices for this conflict. They thought they could win without much trouble if Japan was so foolish as to declare war. "Why, therefore, inconvenience ourselves?" they asked.

All these conditions contributed to give Japan absolute control of the sea. A comparison of forces at the seat of war shortly before February 8, 1904, will show, moreover, that had the Russian bluejackets been as good men as their opponents, and had they been animated by as consuming an enthusiasm, the victory would most likely have been to the Japanese. In battleships, the squadrons were about equal with a slight advantage to the Japanese. The eight Japanese battleships had an aggregate tonnage 95,517, and armament of twenty-eight 12-inch and eighty-eight 6-inch guns. The tonnage of Russia's eight battleships was 92,048, and their armament twenty 12-inch, twelve 10-inch and eighty-nine 6-inch guns.

In cruisers, however, both armored and protected, the Japanese had an enormous advantage. The tonnage of the three Russian armored cruisers was 35,540, and their armament twelve 8-inch, forty-eight 6-inch, and six 4.7-inch guns. Japan had nine armored cruisers with a tonnage of 76,022, and an armament of thirty-two

8-inch, one hundred and eight 6-inch, and ten 4.7-inch guns. The Russian protected cruisers, six in number, had an aggregate tonnage of 35,390, and were equipped with fifty-four 6-inch, and six 4.7-inch guns. This squadron looks little beside Japan's squadron of seventeen protected cruisers armed with three 12.6-inch, four 10-inch, eight 8-inch, forty-one 6-inch, and one hundred and seven 4.7-inch guns, and having a total tonnage of 61,843. But whether these facts are sufficient to show that the Japanese naval forces in the vicinity of Korea were stronger than the Russian forces, it is indisputable that the Russian vessels made not a single movement to prevent the Japanese from transporting to the mainland of Korea a large number of troops and an enormous amount of supplies.

It seems as though the Japanese perceived more clearly than anyone else the absolute necessity of perfect control of the sea, for they made no formal declaration of war. They struck the first blow, and got in a good one too, for by it they made it absolutely certain that their fleet should be larger than that of their enemies. Their first blow was not against a land fortification, an attempt to render some stronghold untenable. It was directed against Russia's naval forces in the east. One week after the opening of hostilities that comparison of forces cited above was not still true. Japan, indeed, still possessed all that she had had at the beginning, but Russia had lost two battleships, three cruisers, and one gunboat, destroyed or injured beyond further usefulness, and the rest were afraid to leave port. On the 13th of April the battleship *Probieda* was hopelessly damaged and the *Petropavlorsk* ran upon a mine and was entirely destroyed with the loss of Admiral Makaroff. The loss of this eminent tactician was even a more serious blow to the Russian navy than the loss of the battleships. It settled it for good and all that Japan's navy was supreme in the east. Her transports and supply ships were at liberty to convey supplies and troops to the struggling armies in China, without liability to capture by their enemies.

Not only at the beginning, but throughout the entire war, Japan had absolute control of the sea. In every naval battle the Russians were outnumbered, outclassed and hopelessly defeated. In an attempt to break the blockade at Port Arthur, August 10, 1904, the Russian squadron was at first successful. Owing, however, to the death of the admiral (Withoeft) and the incompetence of his successor, the ships fell into confusion and retreated back into

Port Arthur where they were so closely held that they took no further part in the war.

In an engagement off Ulsan, August 14, 1904, Russia's three armored cruisers in the Vladivostok squadron were opposed by four armored cruisers, four protected cruisers, and a torpedo-boat flotilla. This engagement was marked by the skillful maneuvering of both forces, but the Japanese vessels sank the *Rurik*, and put the other two, the *Rossia* and the *Gromboi*, to flight by their superior forces and more accurate shooting.

In the tremendous effort made by Russia to break Japan's control of the Asiatic waters by putting a fleet in the east practically equal to the Japanese forces, she met with a miserable failure. A comparison of the fleets engaged in the battle of the Sea of Japan will show that Russia did indeed succeed in placing a fleet in the east nominally the equal of the Japanese combined fleet. Russia had the superiority in battleships, eight with a tonnage of 94,804, and an armament of twenty-four 12-inch, seven 10-inch, four 9-inch, and seventy-seven 6-inch guns, against Japan's four with a tonnage of 57,550, and twelve 12-inch and fifty-two 6-inch guns. But in cruisers and coast defense ironclads Japan had the advantage. Russia had nine cruisers and three coast defense ironclads of 59,143 tons, and three 10-inch, eight 9-inch, fifty-seven 6-inch, and forty-four 4.7-inch guns against Japan's eight armored cruisers and fifteen protected cruisers of 131,625 tons, and three 12.6-inch, four 12-inch, four 10-inch, thirty-six 8-inch, one hundred and forty-eight 6-inch, and eighty-nine 4.7-inch guns. The entire Russian fleet was, therefore, of 153,947 tons and had an armament of twenty four 12-inch, ten 10-inch, twelve 9-inch, one hundred and thirty-four 6-inch, and forty-four 4.7-inch guns. This fleet was opposed to one of 189,175 tons, which had an armament of three 12.6-inch, sixteen 12-inch, four 10-inch, thirty-six 8-inch, two hundred and six 6-inch, and eighty-nine 4.7-inch guns.

The fleets were, therefore, not unevenly matched in point of guns and ships, although the figures do show a slight advantage in favor of the Japanese. In accuracy of fire, in the spirit which animated the crews, in the condition of ships and men, in the speed which the fleets could maintain, in knowledge of their ground, there was no such equality or anything approaching equality. It was due to these things that the yellow men accomplished such a wonderful victory at Tsushima and destroyed Russia's hopes of bringing the war to a successful issue. Russia had accomplished

a remarkable feat in sending the Baltic fleet a distance of 13,000 miles to the scene of the war, and keeping it supplied with coal and other necessities in spite of the restrictions imposed by the neutrality of the ports at which the fleet stopped. The fleet arrived in such a condition, however, that it could not withstand the vigorous attack of the Japanese fleet.

This battle settled the control of the sea and the result of the war. It showed that when Japan took the bull by the horns and seized control of the sea before Russia woke up to the fact that war was on, the war was won. Russia might send a fleet from the west to regain control of the eastern waters, but she was sending a fleet to defeat and destruction. Many "level-headed" people considered sending our fleet around South America in time of peace a very hazardous undertaking. To send a fleet around Asia and Africa in time of war, with all the restrictions imposed upon the fleet by the neutrality of the countries through which it was passing, was practically impossible if the fleet was to arrive at the scene of war in condition for making the fight of its existence. Japan was fully assured of her control of the sea. She could continue her operations on land without fear of interruption.

But apart from the fact that the Japanese victories on land were all due indirectly to control of the sea, since without this supremacy she could never have put an army in Manchuria, control of the sea was directly responsible for several of the victories of the Japanese army. It was the work of the Japanese navy, not that of their army, in several battles which defeated the Russian army. At Turrentchen, on May 1, Japanese vessels steamed up the Yalu River and opened fire upon the Russian forces, compelling them to retreat at the moment of victory. It was the defeat of a small squadron sent from Port Arthur by a larger Japanese force that made possible the occupation of the Liotung peninsula by the Japanese and put the Russian stronghold in a state of siege.

At Kin Tcheu the Russian army was compelled to evacuate a position heretofore considered impregnable, due to the work of the Japanese navy. The rapid and accurate fire poured in upon the flank of the Russian forces rendered the position untenable.

In his final order on the dispersal of the combined fleet of Japan, Admiral Togo said: "Heaven gives the laurels of victory in war to those only who keep themselves in training in time of peace, and *win the battle before it is fought.*"* This is what Japan did in the Russo-Japanese war. When she seized control of the

sea at the outset, and so injured the fleet of her enemy that it was unable to disturb her supremacy on the sea, she decided the contest. Practically nothing could save Russia from defeat then, for it was shown by the experience of the Baltic fleet, in the battle of the Sea of Japan, that although by stupendous efforts she might succeed in putting a fleet in the east practically equal numerically to that of her opponents, this fleet would not arrive in condition to defeat the fleet of the sunrise kingdom.

With the sea in the possession of Japan, retreat was the only alternative left to the Russian army. Should the Russian general defeat his opponent and force him to retreat to the sea coast, he could not place the Japanese army in a state of siege, since the latter would have uninterrupted communication with his base. The Japanese could, furthermore, very probably concentrate enough troops at that point to raise the siege. On the other hand the Russians would be adding more miles to the enormous distance they had to bring reinforcements and supplies. This is not the most serious part of it, for the roads along which these supplies would have to be brought were open to attack by sea. If Japan was supreme on this element, how was the Russian army to maintain its line of communications. Clearly, therefore, it was impossible for the Russian army to advance; their only hope lay in retreating, for by this they drew their wily opponents further and further from their base. General Kuropatkin's plan was to yield only as much ground to the Japanese as he had to until the Russian navy could get control of the sea. Then he could advance. But the navy failed to do its part, and on that alone the outcome of the war depended. Russia lost several battles, both on land and sea, but she was really defeated when on February 8 and 9, 1904, Japan destroyed half a dozen of her best ships in the east. Japan accomplished some remarkable victories, both in Manchuria and the Asiatic waters, but she won the victory when she broke Russia's sea power in the east and made possible a war in China. Since, therefore, Japan would have been unable to prosecute a war in Manchuria without the control of the sea, and since this control of the sea was the direct cause of her victories on land, we must add this contest to the long list of wars in which Mahan has shown that supremacy on the sea means ultimate victory.

* Captain Togo: Naval Battles of the Russo-Japanese War, p. 46.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE MEAN POINT OF IMPACT.

By REAR-ADMIRAL BRADLEY A. FISKE, U. S. Navy.

If a salvo were fired from a battleship in a modern navy at a target 10,000 yards distant, the mean vertical deviation of a 12-inch long-pointed projectile of say 2400 f. s. would be between 20 and 30 feet, and the mean deviation in range between forty-seven (47) and seventy (70) yards, depending on the degree of excellence of her gun pointers.

Assuming the three cases of a mean vertical deviation of 20 feet, 25 feet and 30 feet, respectively, and a target 30 feet high, the probability of hitting is shown in the following table. Four cases are considered: one case assumes the mean point of impact to be on the center of the target, another case assumes the mean point of impact to be 50 yards short or over; another case assumes it to be 100 yards short or over, and the other assumes it to be 150 yards short or over.

Mean vertical deviation.	Mean point on center of target.	Mean point 50 yards short or over.	Mean point 100 yards short or over.	Mean point 150 yards short or over.
20 feet	Prob. 45 %	Prob. 33 %	Prob. 12½%	Prob. 2½ %
25 feet	Prob. 36.8%	Prob. 29.8%	Prob. 16 %	Prob. 5.7 %
30 feet	Prob. 31 %	Prob. 27 %	Prob. 17 %	Prob. 8.2 %

To get a clear idea of the meaning of this table let us imagine two hostile fleets meeting in battle, fleets otherwise equal and having gun pointers of equal skill, but one fleet, A, having a means of getting the sight bar range at 10,000 yards with an average error of only 50 yards (no matter what the means might be), while the other fleet, B, had a means whereby the error was 100 yards. In this case, if the gun pointers were well trained and the weather good, the mean vertical deviation would be only about 20 feet, and A would hit B two and a half times as often as B would hit A. Or

if A had a means by which its sight bar range was 100 yards wrong, while B's was 150 yards wrong, A would hit B five times as often as B would hit A. Or if A had a system whereby he got the sight bar range with an error of 50 yards, while B's error was 150 yards, A would hit B 12½ times as often as B would hit A.

Inasmuch as to find the range at 10,000 yards with an error of only 150 yards is a distinct problem, and inasmuch as the conditions of the atmosphere and the temperature of the magazines cause the range of projectiles to vary considerably at any given elevation, and inasmuch as, *if the mean point of impact be near the center of the target,* it is obviously desirable to have the dispersion as small as possible, it would seem that the problem of hitting a distant target at sea is divided into three very well defined parts: first, to find the sight bar range, in order to ascertain how to put the mean point of impact as close as possible to the center of the target; second, to direct and control the fire, and third, to make the dispersion as small as possible.

The first part naturally divides itself into two parts also: first, to find the correct range; second, to ascertain the corrections due to atmospheric and temperature conditions, so that if this correct range be given to the gun pointers the mean point of impact will be near the center of the target. The second and third parts of the problem are, of course, matters of fire control and training of gun pointers.

In June, 1909, the writer published in the NAVAL INSTITUTE PROCEEDINGS an article called "The Sight Bar Range," which contained the following sentences. The range-finders mentioned were Barr and Stroud range-finders of 54-inches base.

> There are two ways of finding the sight bar range; one is by correcting a previous sight bar range by spotting from aloft, and the other is by measuring the range directly with range-finders.
>
> If either method be used, it is first necessary to calibrate all the guns. If the spotting method be used, all guns of each caliber must be calibrated with a standard gun of that caliber; if the range-finder method be used, each gun must be calibrated with the range-finder that is to get its sight bar range.
>
> On October 9, 1908, the *Tennessee* and the *Washington,* being then 2040 yards apart, steered courses diverging three points, by order of the commander of the second division, for half an hour, and then converged three points, taking simultaneous reciprocal range measurements every five minutes, each having first held up her "corrector" for the range-finder of the other ship. Then each telegraphed her measurements to the other ship.

The wind that day was marked in the log as 3 to 4, and the sea as "moderate." The speed was 11 knots and the wind was on the starboard bow. The conditions for range-finder work at sea seemed average, except the rate of change of range, which was much greater than would probably occur in battle, being 162 yards per minute.

There were 13 observations varying between 2040 yards and 7300 yards. The average disagreement between the range-finders was 33 yards, and the square root of the average of the squares of the ranges was 4874 yards. That is, the disagreement between the two range-finders was 33 yards at 4874 yards.

It is mathematically probable that the true ranges were somewhere between the measurements given by the two range-finders; that is, that the average error of the two range-finders was probably 16½ yards at 4874 yards; which is 25 yards at 6000 yards.

It may be objected that the true range may not have been between the readings of the two range-finders, because both range-finders may have read either over or short. This, of course, is true; but if so, the reason was simply that the marks on the "correctors," which were made on board the *Tennessee*, may not have been placed at exactly the right distance apart; but this would be an error wholly remediable, because the Washington Navy Yard could easily make correct correctors.

However, I had the accuracy of our corrector tested at a known range, when the ship anchored at Panama, by sending our corrector on board the *West Virginia*, correcting both our range-finders by it, and immediately thereafter taking twenty measurements of the distance of the cathedral with each range-finder.

Mr. Russell took these observations, and the mean of twenty observations with the Barr and Stroud range-finder No. 883 was 6949 yards; and with range-finder No. 882 was 6956 yards. The average disagreement of the readings of range-finder No. 883, with its own mean, was 11.8 yards; of range-finder No. 882, was 14.9 yards. The range of the cathedral, as measured from the chart, our position being plotted with the utmost care, was 6925 yards. Mr. Russell took every precaution against self-deception, being honestly anxious to ascertain the truth.

The difference between 6925 yards and 6956 yards is 31 yards; and the error corresponding to 31 yards at 6925 yards is 23½ yards at 6000 yards.

The writer feels justified in concluding therefore that, *with an amount of training no greater than that given a gun-pointer*, the error of the range-finder method, used at sea under average conditions, may be assumed to be about 25 yards at 6000 yards.

This takes no account of the fact that the range-finder is an instrument that can be improved, and that one can practice with it a great deal at sea.

* * * * * * * * *

Thus far, no mention has been made of any factor except accuracy.

Therefore, it may be objected that, even if it be granted that the range-finder method is the more accurate when no guns are firing, yet the range-finder itself is liable to be jarred out of adjustment by the shock of gun-fire.

To this may be replied that—

(a) The turret range-finder mounted on top of the turret of the *Arkansas* now the *Ozark* was not jarred out of adjustment when five 12-inch shots were fired, on April 15, 1907.

(b) The range-finder of the *Tennessee* was not jarred out of adjustment at her battle practice in November, 1908. Of course, the shrouds and stays of the lower mast and topmast were up taut and the pedestal of the range-finder was carefully stayed.

(c) It is easy to make a range-finder so strong, mechanically, that it could not possibly be jarred out of adjustment.

It may also be objected that the vibration of ship during gun-fire is so great that no observer could possibly get range-finder readings.

To this it may be replied that there must be occasional "cease firings," in order to ascertain the range, no matter what method be employed. When using the spotting method it is necessary to wait after each turret shot or salvo until the splash is seen before any correction can be made to the last sight bar range, say 10 seconds; similarly when using the range-finder method a new measurement can be begun in less than five seconds after the discharge, and completed in five seconds more—under average conditions. This ten seconds is not time lost, in either case, because during this time the guns are being loaded.

POSTSCRIPT.

Since this article was mailed to the Naval Institute it has been pointed out that the article may be construed as advocating the abolition of spotting. The article does not advocate the abolition of spotting.

The writer believes in spotting; that is, in having observers above the smoke, who tell, from the fall of the projectiles, whether the range used was too small or too great.

He believes, however, that spotting should be auxiliary to range finding; not that range finding should be auxiliary to spotting.

It seems to him that the principal rôle of spotting is simply that of raising or lowering the mean point of impact, by correcting for some *actual* change of I. V. of the index of powder being used, *if it occurs*; or some change in the "coincidence adjustment" of the range-finder, *if it occurs;* or for both.

So why not use spotting simply to regulate the coincidence adjustment of the range-finder (or range-finders) and raise or lower the mean point of impact in this way? This can be done by a simple mechanical device.

The danger of depending upon spotting alone may be seen when we recognize the fact that, if the enemy has good range-finders, and if the enemy's admiral, after the fleets are drawn up in parallel columns, will carry out the well-known "follow my leader" tactics, changing the course of the leader back and forth, say one point each side of the middle course, he will change the range irregularly and frequently, back and forth, about 93 yards a minute; the fleet speed being here supposed to be 15 knots.

The gradual changes of course and distance will not bother the enemy's range-finders, so they can keep our range all the time; but on our lofty and

exposed fire-control platforms, our armies of spotters, change-of-range-projector-men, and telephonists will not be able to find and transmit correctly the sight bar range.

Since this article appeared the writer has heard many arguments among officers on the subject of getting the mean point of impact on the target; the minority contending that the range-finder offers such a promising means that we should do our utmost to get good range-finders, to mount them on pedestals as short as possible, on as firm foundations as possible, with covers to protect them from the wind, and that we should train a body of range-finder observers at least as carefully as we train gun captains; the majority standing firm on the platform that it is useless to work along this line, because "practical tests in the fleet" have conclusively proved that the range-finder is inaccurate and unreliable.

Other navies, especially the British and the German, have a greater respect for the range-finder than we have. This was to be expected of the British, because the Barr and Stroud range-finder is a British product, and the British Navy made exhaustive tests of that instrument many years ago. But the Germans seem to have stolen a march on everybody and to have solved scientifically and practically the whole problem of placing the mean point of impact on the target. If our information is correct they *have already devised and adopted* a method of applying the necessary temperature and weather conditions to the range tables, and *have already actually built range-finders of long base into their turrets,* where they are protected not only from gun fire, but from the wind, and where they can be given a mounting very firm vertically, but leaving the instrument free from bending forces horizontally, thus almost eliminating the effects of the vibration of the ship and the shock of gun fire.

If our information is correct (and it probably is) the Germans have employed their marvelous ability in applying the principles of science to practical affairs (which is the most potent single cause of their pre-eminence in all departments of endeavor, which ability is developed in their leaders to the point of genius)—they have employed this ability to increase the fighting power of their fleet by a means as efficacious as the increase in the number of the ships.

Our attitude towards the range-finder is freely disclosed in the *Navy Register,* which is not a confidential publication, but is sent

everywhere. The *Navy Register* shows by the ratings given to men, and the extra pay allowed for various services, the values which we attach to various positions and duties. There is not one word said about range-finder observers, and yet practically every other specialty in a ship is recognized. Besides the various ratings themselves we have over a dozen positions in which special remuneration is awarded; which practically states to every navy the fact that we attach no importance whatever to range finding.

Yet there is no work in a ship which requires greater skill than that of range finding; in fact, it may be truthfully asserted that more special and personal skill is required to do range finding *under difficult conditions* than to do any other work on board ship.

Not only is this work difficult, but it is exceedingly important. It is to be exercised in the most critical time that a naval officer can imagine—the opening of a battle—in those few pregnant moments that decide which fleet is to secure the initial advantage—almost the same thing as victory.

Yet our *Navy Register* shows that we attach less importance to the man who is to get us the opening range in battle than to a coxswain of a steam launch, captain of the hold, jack-o'-the-dust or tailor's helper.

One result of our attitude is the well-known fact that we have not a single trained range-finder observer in the navy. Another result is that we thoughtlessly mount our range-finders on flimsy supports, where they vibrate tremendously, and are literally "shaken with the wind."

Another result is that we have allowed another navy to get ahead of us in a matter which involves victory or defeat in battle, and in which we took the lead five years ago.

A peculiar phase of the situation is the small amount of training needed in order to get fairly good results. During the past year the writer has caused the Barr and Stroud range-finders of the Fifth and Third Divisions to be used whenever occasion offered; and in all cases the instrument has seemed to respond gratefully to good care and skilful handling.

On June 30, 1912, while at anchor at Key West, I directed Lieutenant (j. g.) Frank Russell and Ensign Leslie L. Jordan, who had had a fair amount of experience with the range-finder, to take a series of ten readings each of the distance of the Sand

Key Light House. The range-finder (15-foot base) had not been corrected for two or three weeks, and we did not know the exact distance of the light house, but these readings would show how closely the range-finder would repeat. The mean of Mr. Jordan's readings was 10,746 yards, and the mean of the variations of his readings from 10,746 yards was 39.7 yards. The mean of Mr. Russell's readings was 10,743 yards, and the mean of his variations was 29.1 yards. In all cases Mr. Russell and Mr. Jordan made the optical contact without knowing the reading of the scale, and *then* read the scale.

Mr. Russell then took ten readings of an uncharted smoke-stack. The mean of his readings was 12,020 yards, and the mean variation of his readings from 12,020 yards was 30 yards.

As this was extremely good, I determined to ascertain the degree of accuracy of the range-finder at the first opportunity.

On July 3 I had the position of the *Georgia* very carefully plotted. The distance of the lighthouse from the position of the range-finder was measured on the chart as carefully as possible and found to be 11,050 yards.

I then directed the *New Jersey* to hold up her corrector board to the *Georgia*, and directed the *Georgia* to adjust the 15-foot range-finder on the forward turret by the *New Jersey's* board. This was done, but as soon as it was done the ship swung so that the range-finder would not bear on the lighthouse.

The next forenoon, however, the ship swung back to her former position, and Mr. Russell took the following ten readings:

No.	Readings.	Variation from Mean.	Variation from Range by Chart.
1	11,025	5	25
2	10,975	45	75
3	11,000	30	50
4	11,050	20	0
5	11,050	20	0
6	11,025	5	25
7	11,050	20	0
8	11,025	5	25
9	11,075	45	25
10	11,025	5	25
10	110,300	200	250
Mean	11,030	20	25

Half an hour later Mr. Jordan took the following ten readings:

No.	Readings.	Variation from Mean.	Variation from Range by Chart.
1	11,075	17	25
2	11,100	42	50
3	11,025	33	25
4	11,050	8	0
5	11,105	47	55
6	11,050	8	0
7	10,995	63	55
8	11,100	42	50
9	11,005	53	45
10	11,075	17	25
10	110,580	330	330
Mean	11,058	33	33

The conditions under which these observations were made were better than the average; the atmosphere was fairly clear, there was not enough wind to shake the instrument, and the ship was steady. Yet, it must be distinctly comprehended, these conditions did not increase the accuracy of the range-finder; they merely permitted accuracy to be obtained without requiring a very high degree of skill from the observer.

The tests made in the *Georgia* supply a curious and gratifying verification of the results obtained in the *Tennessee*. To say that the results obtained in the *Tennessee* as published in the INSTITUTE PROCEEDINGS were received with incredulity would be to put the matter mildly; but nevertheless they were correct. In the article published in the INSTITUTE PROCEEDINGS the conclusion was, "With an amount of training no greater than that given to a gun pointer the error of the range-finder method used at sea under average conditions may be assumed to be about 25 yards at 6000." Now this was with a 54-inch range-finder. With that range-finder the error at 11,000 yards would have been 25 multiplied by 11^2 divided by 6^2, or 84 yards, supposing the atmosphere to be perfectly clear in both cases. With a similar range-finder having a 15-foot or 180-inch base the error at 11,000 yards would have been 84 multiplied by 54 divided by 180, or 25.2 yards.

If it be granted that these tests prove that the range-finder itself is accurate, and that, if properly handled under favorable conditions, excellent results will be obtained, it remains simply to

recognize the fact that unfavorable conditions, such as vibration, wind and relative movement between target and range-finder, do not, and cannot, alter the accuracy of the range-finder as an instrument. They merely make it necessary for the observer to be skilful.

This seems to mean that we ought to mount range-finders properly, and to train observers, so that under difficult circumstances we shall be able to take advantage of all the accuracy of which the instrument is capable, shorten the time of getting the mean point of impact on the target, and keep it as close to the center of the target as possible.

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NOTES ON THE APPLICATORY SYSTEM OF SOLVING WAR PROBLEMS, WITH EXAMPLES SHOWING THE ADAPTATION OF THE SYSTEM TO NAVAL PROBLEMS.

By MEMBERS OF THE STAFF, U. S. NAVAL WAR COLLEGE.

THE ESTIMATE OF THE SITUATION.

This is the foundation upon which is based the deductive or applicatory system of studying and solving war problems.

This system is the ground work upon which the Germans have been building for so many years, and to which all military writers ascribe her wonderful development in leadership and in knowledge of the art of war.

It stands alone, without a rival, and has so stood for a hundred years. It has been consecrated by success in its application to conditions of war, and it behooves any who would seek to gain efficiency in the art to follow in the wake of its most successful teachers.

We have not been diligent, heretofore, in getting at this root of success; to see in what kind of substance it germinated and from which it extracted vigorous life.

We should not at this late day disdain to begin our professional life anew so far as it is concerned with the study of the art of war, and begin at the A B C, which we have too long neglected in our desire to practice without its knowledge.

We are in exactly the same position as the youth at school who chafes at his books and longs to get out into the practices of life. He disdains the course that the experience of ages has shown to be the best and surest road to success. He goes forth into life a mediocre man; or, if he achieve success, it is because of other attributes the development of which by proper training would have assured to him a higher success.

It is equally true that no amount of education or training would assure success to some, but no one can deny that careful and assiduous training is vastly beneficial even to the stupid.

So with this system of training in war—it is not designed to create genius. That springs from a seed of its own, the germ of which has never yet been discovered. Its whole aim is to provide a higher education, a better training for the mass. It will not stultify genius, and it will raise the standard of average ability.

This system of training had its origin in the Prussian general staff many years ago. It was not, however, until after the successes of Prussia in her war with Austria, in 1866, and the successes of United Germany at war with France, in 1870, that other nations were led to inquire seriously into her system of training.

Not until then was its principle grasped and its efficacy appreciated. But unfortunately we were not among those who felt the necessity of thus reasoning from effect to cause.

We, as a nation, are reluctant to shape our course in accordance with foreign standards.

We are surfeited as a people with an overweening self-sufficiency that is a natural outgrowth of our origin and development as a nation and our position in the world.

As military men we have inherited this trait and have therefore been slow to recognize the virtues in any system of training that has not been evolved by us.

It may be pardonable for the masses to feel that the military inheritance left us by those who fought in our past wars discounts any system of training evolved or discovered abroad.

But it is not pardonable for military men, whose profession is the conduct of war, to fail to search out the truth; and, having found it, by whomsoever discovered, to fail to follow it.

It has only been a few years since the voice of command was heard in our army, and that voice demanded criticism of our past military history and not blind worship of ultimate results. It demanded that, at least among military men, war be studied according to a system, and as there was but one system they embraced that one.

Now, war is war; and whether we choose to study it as army or navy men, it is still the same subject, only handled with different tools.

We cannot learn how properly to use those tools until we know something of the art that we are going to practice with them. Knowing the art is common ground for us all, knowing our tools is our especial science; but each with his own tools may become better able to apply them to the task co-operatively if each is well grounded in his knowledge of the art.

Strangely enough, we of the navy, with all our spirit of alertness and progressiveness in perfecting the details of our instruments, have not yet awakened to the fact that there is an art in the employment of those instruments in combination as well as a science in their use as individual units.

Or, if we have appreciated the existence of the art, we have failed to realize the virtues of the only known, well designed system of training that alone can lead us to a higher development of our profession and make us fit for the conduct of war.

That we may not longer continue in ignorance of our basic necessities, the endeavor of this paper will be to lay bare once more the principle; and to urge the importance of grounding our study of war upon a system that has been and is a torch of progress in the art, and which we have hitherto failed to see; or, seeing, have not firmly grasped.

The events that led up to the formulation and adoption of this system of training are interesting historically and illuminating.

We all know how the armies, led by the genius of Frederick the Great, established the integrity of Prussia and became the model in discipline, organization and training for all the continental powers.

We know, too, how intolerant of criticism or of suggested change in method were the leaders who came after Frederick the Great.

How could any system of training for the conduct of war in the Napoleonic era be better, they maintained, than the brilliant heritage left to them in Prussia less than 50 years before by the great king?

Steeped in their self-sufficiency, disdaining to learn from events that forecasted a radical change of system, they had their awakening at Auerstadt and at Jena in 1806.

The disasters that there befel the Prussians were not incident to any decay in their race, their spirit, or their fortitude; nor to a neglect in their training according to the system that had been handed down to them.

They were still soldiers in every sense of the word; and they were pitted against soldiers, in 1806, no more valiant than those over whom their fathers had won so many victories under the great Frederick.

The causes were elsewhere to be sought; and out of the overwhelming disasters of Auerstadt and Jena, and the utter humiliation forced upon Prussia by the treaty of Tilsit, in 1807, there sprang a spirit of determination to search out and expose the truth.

The truth that seemed to stand out as particularly condemnatory of their highly prized organization and system of training was, that it needed the genius of a Frederick the Great to make it effective in war.

They realized that they did not have a Frederick the Great; that they were living upon a tradition; and that, therefore, when the first clash came, with the great genius of modern war, their organization and system went down to utter defeat and ruin.

They may have realized, too, that Napoleon's system of training possessed the same inherent weakness that underlay their own; for Napoleon's system, deprived of the genius of his own leadership, met defeat more often than it did victory.

It is a significant historical fact that Napoleon's marshals, with probably but one exception, Davout, after many years of active campaigning under his direction and guidance seemed, when acting independently, unable to apply successfully, against the forces opposed to them, the principles of grand tactics that made their master the greatest soldier of modern times.

The general principle underlying the deductions made from their experience by the Germans, relative to a system of training, seems to have been that it is *safer and wiser to develop by training a high average of ability* in leadership than to trust to untrained "common sense" or to the development of a genius in time of war to lead mediocrity to success.

In this crisis the Prussians were fortunate in recognizing the wisodm of Scharnhorst, who pointed out to them the way that ultimately led to victories of even greater import to Prussia as a nation than her former defeats had been.

Under his guidance was instituted a real staff college, whose function was to take up the studies of campaigns and to formulate, solve and discuss concrete war problems.

These problems seemed at first to be based only on the studies of past campaigns, but later they were cast also in the mold of possible future campaigns.

Under the direction, first of Scharnhorst, then of his pupil Muffling, and, for 31 years prior to his retirement, in 1888, of von Moltke, this system of training was developed. In 1870 its fruition was seen in the unbroken succession of victories over the French, whose generals, be it remembered, had had far more experience in the field in active operations than the German generals had had up to that time.

Thus was inaugurated and systematized what may be termed a new art—the art of waging war in time of peace.

The basis of this system of training is founded upon a method of teaching how to approach the solution of war problems. It is, therefore, in its beginning a training in mental processes. Later the conclusions derived from the mental processes are translated into action.

This system of training embraces three phases.

The first phase is embodied in the estimate of the situation—a mental process which leads up to and expresses the decision, or what, under the circumstances, you have made up your mind to do.

The second phase teaches us how properly to translate the decision into an order. Having made up your mind to do something, how are you going to do it?

The third phase translates the mental processes into action and has to do with carrying out on the field or in the game the tactical or strategical dispositions made in the order.

At first it may seem to savor of a return to class-room days to have to make what appears to be a labored preliminary to a decision on a war problem, but we must bear in mind that we are dealing in war with an art in the practice of which we are mere tyros, and for the study of which we have, heretofore, employed no tangible system of training or practice, and it behooves us to make our profession our business.

Short cuts to fame in the art of war are reserved only for the genius.

Were there other equally good and more direct methods of learning how properly to solve a war problem, or how to obtain in a concrete way a training in time of peace for the conduct of

war, it is safe to say that it would have been discovered at some time during the hundred years that have passed since the inception of this system.

When this system of training is thoroughly understood and sedulously practised it ensures the development of military character. It trains the individual in military judgment, in decision, in command and leadership.

It assures thoroughness and similarity of treatment of any war problems. This feature of its method, combined with a good knowledge of military history, leads, under good direction, to a proper application of military principles and to an approximate agreement in judgment or decision. If it does not accomplish this end entirely, it, at least, tends to eliminate that which is inherently and essentially erroneous.

All this ensures to a superior the guarantee of a trained judgment in his subordinate, and inspires that confidence that leaves untrammelled and stimulates the exercise of initiative on the part of a subordinate.

The first phase of this system of training is embodied, as was stated before, in the estimate of the situation.

This is a term used in a military sense to express that logical process of thought, which, applied to a concrete strategical or tactical problem, enables one to arrive at a definite strategical or tactical decision.

It involves a careful consideration, from the commander's viewpoint, of all the circumstances affecting the particular problems.

It embraces a full consideration of any strategical or tactical situation under four subheads, namely:

1. The mission.

2. Enemy forces: Their strength, disposition and probable intentions.

3. Our own forces: Their strength, disposition and courses of action open to us.

4. The decision.

The mission is a clear and concise statement of the orders or instructions under which the commander is acting or a statement of what he deduces from his knowledge of the situation.

It is an answer to the question: What is the task set before me?

Quoting from Captain Roger S. Fitch's pamphlet on the sub-

ject of Estimating Situations, we find the requirements of the mission clearly set forth and expressed as follows:

When a command is acting merely as an integral part of a larger command its mission is ordinarily determined for it by higher authority. In the case, however, of a practically independent command, or in any case where a force is acting under instructions of a discretionary nature, the commander will ordinarily have to deduce his mission from his knowledge of the general situation, his acquaintance with the intentions or desires of the superior who sent him forth, and his appreciation of the existing military situation.

Although each situation influences the mission and conduct of an independent leader in quite a different manner than it would if his command were directly dependent upon another, and he himself merely obeying precise and definite orders susceptible of but one interpretation, yet in the one case no less than in the other, the general purpose of the supreme commander must always be borne in mind. The means, however, by which the general purpose may best be furthered will differ greatly. As General von Verdy says: "The officer who suddenly encounters the enemy while patroling with his platoon must conduct his actions from a different point of view than if he commanded his platoon as skirmishers in front of his company. A division in an army corps will generally be so situated that it must carry out an action even though it be completely annihilated in so doing, and then it would still be promoting the general purpose; on the other hand, a division widely separated from an army would, as a rule, utterly fail to accomplish its mission if it allowed itself to be annihilated."

Under the second sub-head—Enemy forces—we should deduce from the best reliable information at hand, what his strength is, how disposed, and what his probable intentions are.

It seems manifest here that, if the judgment of one who is estimating the situation for himself is trained and practiced, he will, by putting himself in the place of the enemy commander, conceive with good judgment what that commander would or should do. His decision would, therefore, be based on better knowledge of the enemy's probable intentions than if he merely made a rough guess of the basis of outward indications of the enemy dispositions.

Under the third sub-head—Our Own Forces—a statement of the strength of our own forces and all the circumstances that may have a bearing upon the relative strength and mobility of the two opposing forces is comprehended.

Then follows a review of the various courses of action open to our forces that might lead up to the accomplishment of the mission.

These courses of action should be clearly outlined and definitely considered.

When we have gotten so far in our estimate we should be prepared to weigh carefully the various methods that suggest themselves as possibly satisfying the demands of the mission; and, by a process of elimination we arrive at the fourth subhead of the estimate—The Decision.

I cannot do better than quote here from Captain Fitch's digest on the Decision.

> Having carefully weighed the advantages and disadvantages of the various methods open to him, the commander should *definitely decide upon the one plan of action which promises the best opportunity of enabling him to accomplish his true mission.* A commander's decision upon a single definite plan of action is therefore the culmination of his estimate. It is the cap-stone of the structure which he has built upon and around his mission.
>
> Buddecke, after stating that the marks of sound tactical procedure are "simplicity and a firm adherence" to the line of action adopted, says: "The decision, once reached, must be unwaveringly carried out with our whole energy. This condition is of so great importance in tactical affairs that the best course of action, if carried out half-heartedly, will come to naught, while a mistake in the choice of courses can often be entirely offset by decided and confident action."
>
> As Griepenkerl says, *"Arrive at a definite decision.* . . . . I warn you against half measures. For example, if you have decided to attack, do so with all your troops! if you wish to retreat, do not come to a halt again after a few miles without the weightiest reasons. *Be perfectly clear in your own mind what you want to do and* then carry it out to the letter."

The ideal employment of the system would be a combination of its three phases in any one situation; that is, assuming any war problem, make first an estimate of the situation on each side which leads to a decision; then write the orders to carry the decision into execution; then carry on the action on the game board to test the decision and order.

That would consume more time than can be allotted in the short session of a summer conference, and we would hardly be prepared to go so far until we have had necessary practice in the elements of the general scheme.

We shall have accomplished a satisfactory result and all that could be expected in the time if we become thoroughly acquainted with those elements.

In considering the problems it is well to have in mind certain pertinent facts.

The main one is, to confine yourself to the problem in hand. Solve that problem and not one that you may think is more probable or better.

There were cases last year (1911) when members did not like the conditions laid down in the problems, and their solutions were influenced by considerations not comprehended in the situation placed before them.

That this is not an unusual or altogether unreasonable attitude can be seen by historical reference that is at once interesting and illuminating.

In von Moltke's verbal criticism of the solution of his 53d problem, presented to the German Staff College, in 1876, there is found the following comment:

Some other gentlemen have made the situation still more difficult for themselves than that which the problem presented, and have assumed that the enemy is standing already at Dasdorf, and had already occupied the defiles of the Wandlitzer See, and at Stolzenhagen. There are some even who imagine the enemy to be already at Zerpenschleuse. They said to themselves: "Since the enemy comes from Berlin, he can just as well march those 16 miles to Basdorf." Well, it is possible, but the problem says nothing about it. The enemy can certainly march with the cavalry and artillery, and let the infantry go by rail to Bernau, in order to keep it as fresh as possible.

I admit that the whole siuation, so briefly stated, is somewhat improbable. A Prussian division is marching from Frankfort to Zehdenick, while the enemy is at Berlin. But to state everything in the problem, the whole history of a campaign would have to be given as an introduction. Not till then could one say: "That is possible and that is impossible."

I have taken the 5th division because its composition is very simple and known to all. I could just as well have taken a Swedish or Russian division, but then we had to work with troops unknown to us. Gentlemen, you had therefore to accept the situation simply as the problem stated it, and not to look for anything special beyond what is given, otherwise there is no limit to speculation. The enemy need not at all come from Berlin; he can also come from a greater distance. You, therefore, must not look behind the situation for a special trick, and think we wish to lay a trap for you.

Also in his criticism of the solution of his 59th problem we find as follows:

You will get one more problem which is simpler, and you will work it out simply also, and not bring in things which lie outside of it. If gentlemen have puzzled their heads as to whether the 12th and 13th Army Corps are following behind the 11th Army Corps, if they ask: What will

happen if the enemy makes a left turn at Kerstenhausen in order to unite with the Western Corps somewhere in Westphalia, or if he advances on Cassel on the right bank of the Fulda? Well, gentlemen, these are quite new problems, and all the military, strategical, and political circumstances would have to be presented to you. You must confine yourselves to what is given.

In conclusion, I wish further to remark that a logical development of the idea, a correct and clear manner of writing, and a good style are also factors which have something to say when the problem is criticised, even if it is not solved exactly in the sense which presents itself to me as correct.

It is not within any one's province to say with authority that any one solution is the correct one. The effort is to reach a good, logical and acceptable solution. No more is demanded and no more can be expected.

It is significant in this regard to quote again from von Moltke's remarks in connection with his 53d problem:

This, gentlemen, is only an example; in it I have given you only my opinions; this does not preclude others from being equally correct.

Again in his criticism of the solutions of his 63d problem he says:

Other gentlemen have arrived at different results. That cannot be wondered at; different opinions may exist, if they are only brought out in a logical and clear manner.

Again in his treatment of the discussion on his 65th problem he says:

There are several papers which have not adopted exactly the same measures which I propose, but which are clearly and logically written, and from which a correct military judgment may be inferred. That is the main point, for in war as well as in art there is no fixed rule; talent cannot in either be replaced by a regulation.

In respect to the method of handling the discussion, if members of the conference should feel that the discussion is too much abridged and that it does not lead to a final consensus of opinion on the solutions presented, it is submitted that our allowance of time does not permit of protracted discussion, and that a consensus of opinion, even if desirable, would be difficult to obtain.

In this connection it is interesting to quote from von Moltke and get his idea on the method of closing a discussion on a problem:

Well, gentlemen, I must unfortunately break off these exercises. I think if we had still more time and could discuss some of the answers, we would very easily come to an understanding.

In closing I wish to state that various authorities support the views herein expressed. The views of this eminent authority, von Moltke, on strategy as given in one of his discussions, and his conclusions as to the only methods of furthering education in the art of war, are here quoted:

That is nearly all that I have to say in reference to these papers. If one wishes to answer such questions as are set here, one likes to look for certain rules and axioms. Such can, however, be only offered by science, and that in our case, is strategy. But strategy is not of a kind like the abstract sciences. These have their invariable and precise truths upon which we can build, and from which we can draw further conclusions. The square on the hypothenuse is always equal to the sum of the squares described on the sides which contain the right angle; that remains always true, be the right-angled triangle large or small, be its vertex turned to the east or the west. . . . .

Strategy is the application of common sense to the conduct of war. The difficulty lies in its execution, for we are dependent on an infinite number of factors, like wind and weather, fogs, wrong reports, etc. If, therefore, theoretical science alone will never lead us to victory we must nevertheless not entirely disregard it. General V. Willisen very truly says: "It is only a step from knowing to doing, but it is a still greater from not knowing to doing." The best lessons for the future we draw from our own experience; but as that must always be limited we must make use of the experience of others by studying military history. Besides which, another means of furthering our education is the working out of such supposed warlike situations as our problems present.

PROBLEM.*

Situation.—War was declared between Red and Blue 18 January, 1909. The Blue main fleet left Guantanamo on that date for

* In problem work, types of vessels are indicated as follows:

AA All big gun battleships.
A Battleships, 1st class.
N Battleships, 2d class.
BB Battle cruisers.
B Armored cruisers.
M Monitors and C. D. vessels.
C Cruisers, 1st class.
F Cruisers, 2d class.
D Gunboats.
S Naval scouts.
E Merchant scouts.
V Destroyers.
t Torpedo boats.
g Torpedo gunboats and despatch vessels.
sm Submarines.

the Pacific via Magellan Strait. The Pacific detachment under command of Rear-Admiral J— is at Seattle. This detachment consists of 6 B, 4 C, 5 V and 3 colliers.

On 10 February, 1909, at 9 a. m., Rear-Admiral J— receives information that a large Red convoy of transports with escort was sighted at 6 a. m., 8 February, in Lat. 51° 30′ N., Long. 160° W., steaming eastward, speed about ten knots.

The Pacific detachment is organized as follows:

Division Ten.
REAR-ADMIRAL J——
B-1, B-2, B-3.

Division Eleven.
REAR-ADMIRAL H——
B-4, B-5, B-6.
REAR-ADMIRAL J—— commands.

Division Thirteen.
CAPTAIN W——
C-1, C-2, C-3, C-4.

Destroyer Division Seven.
COMMANDER F——
V-1, V-2, V-3, V-4, V-5.

Required.—Rear-Admiral J—'s estimate of the situation.

ESTIMATE OF THE SITUATION.

Mission:—To prevent this enemy force from landing on our coast.

Enemy Forces.—Their strength, disposition and probable intentions.

Information regarding the strength and disposition of the enemy forces is very indefinite. All that is known is that there is a large convoy of transports with an escort steaming towards our west coast. The escort would likely be a formidable one, for such a movement on the part of the enemy would indicate that he was directing his maximum effort towards invasion, and the protection necessary for the transport of a large body of troops would entail the employment of a naval force very considerably superior to any force that we might at present be able to send against it.

The necessity of guarding the convoy, however, entails a tactical weakness which might be taken advantage of.

Judging from the position in which this force was sighted and its course, it seems most probable that it is proceeding on a great circle course from the enemy home country to the Puget Sound region. The enemy, therefore, probably intends to occupy that region as the first step in his invasion.

This force will probably be proceeding with a strong screen well advanced from his train and from the main body of the escort. At night he will probably adopt a close screening formation around his train.

Our Own Forces.—Their strength, disposition and the courses of action open to us.

Our own forces consists of 6 B, 4 C, 5 V and 3 colliers. This force, though small, represents all that we have in this theater of war.

There is nothing else with which to oppose the evident purpose of the enemy, and the situation demands immediate and well directed activities.

The courses of action open to us are:

1. To remain within the waters of the Puget Sound region; to deliver an attack upon the convoy in those waters in case that be the enemy objective.

2. To proceed to gain contact with the enemy forces to determine their strength and dispositions with a view to attacking the convoy before it arrives on our coast.

Inasmuch as the strength of the enemy escort is not known, and since it may be much stronger than the forces in this command, it would be extremely hazardous to await his entrance into the Straits of San Juan de Fuca before preparing an attack.

The enemy will realize that he will be opposed by whatever force we may have, and if he reach the straits unmolested he will be in a position to guard the entrance, after his convoy shall have passed, against any force that may try to enter, and he will be able to push ahead a strong reconnoitering force to uncover the position of any naval force of ours that may be inside the straits or the sound. He would then be able either to defeat or contain that force and it could no longer menace his convoy.

Our naval force inside the straits could for a time be under the protection of the series of Puget Sound fortifications, but they could be contained behind those fortifications, and the work of landing the enemy troops could be carried on with security.

Employed in this way our naval force would come in the category of what Admiral Mahan has called a "fortress fleet," and which he designates as a faulty and vicious employment of an active naval force.

The fortifications would most likely fall because they could be taken in reverse; and when that time comes, this force, employed behind those defenses, will be lost without accomplishing its mission or seriously menacing the progress of the enemy's campaign.

The first course mentioned must, therefore, be rejected. The second course mentioned conserves the mobility of this force, and tends to clear up the situation by providing us with information relative to the strength and disposition of the enemy's escort, which is an absolute necessity in order that proper dispositions can be made with a view to harassing and attacking the convoy.

Bad weather conditions, likely to be met with at this season of the year in the northern Pacific Ocean, may cause a considerable elongation of the enemy's formation beyond his power to successfully protect; it may even cause a scattering of his force. These conditions should be favorable to our purpose and they are possible advantages that we should be in a position to grasp.

Decision.—To proceed to sea with my entire force with a view to attacking the enemy convoy.

This completes Rear-Admiral J—'s estimate of the situation.

Having arrived at the above decision, based upon the reasoning which precedes it, Rear-Admiral J— then concerns himself with the tactics of the dispositions he intends to make of his forces and arrives at the following tactical decisions as a basis of his orders:

TACTICAL DECISIONS.

1. To proceed at noon.
2. To follow great circle course from Tatoosh towards point where enemy was sighted.
3. To form a scouting line of 40 to 50 miles in advance of main body with 25 miles between vessels.
4. To keep armored cruisers and destroyers together.
5. To send colliers to rendezvous 60 miles S. W. of Cape Disappointment.
6. To appoint a rendezvous for combatant vessels 20 miles West (mag.) of Tatoosh Id.
7. To use cipher B for wireless.
8. To remain in B-1 with main body.

CAMPAIGN ORDERS.

Both before and during the progress of military and naval operations, the general plan and strategic objective will probably be laid down in letters of instruction issued by the commander-in-chief or other superior authority.

Routine orders will govern administrative features, and include general orders, special orders and circulars.

In naval operations tactical movements will generally be directed by signal.

Campaign orders will apply to situations comprising both strategical and tactical features, and in character and scope are intermediary between the letters of instruction and tactical signals. Ordinarily campaign orders will not include administrative details, which are better left to general and special orders.

The commander first makes an estimate of the situation, and on that bases his decision upon a definite plan of action. He then proceeds to draft the orders carrying the decision into effect. These orders then are the means employed by the commander to acquaint his subordinates with the disposition of the enemy's forces, and of his own supporting forces, his decision, and the character of co-operation expected of the various units of his command.

The form for naval compaign orders is virtually the same as that adopted by the army for field orders, this in turn being based on the German "Operation Order." Some alterations in the army form have already been made to adapt it to naval conditions, and organization, and it is possible that other changes may become necessary after sufficient experience in use of the form.

For army purposes, field orders are issued orally, by dictation, or, in writing, though *written* orders are the rule. For naval purposes, campaign orders will be written and addressed to the subordinates charged with the execution. On occasions they must be sent by wireless, their adaptation to this method of transmission constituting a question to be discussed, when the form of the order itself comes up for discussion.

As the form in use at the Naval War College is based ultimately on the German model, reference is made here to the various German authorities and to the Field Service Regulations of our Army.

In formulating a solution to a military order problem, Griepenkerl lays down the following requirements:

1. Read the problem carefully several times, map (chart) in hand.

2. Study carefully on the map (chart) the ground (region) under consideration.

3. Realize accurately your own situation and that of the enemy.

4. Read the appropriate sections in the Tactical Guide (Tactical Signal Book). On principle, verify everything about which you may be anywise in doubt.

5. In the movement of troops (forces) calculate by measurement of distances, the time necessary.

6. Consider the counter measures likely to be adopted by the enemy.

7. Arrive at a definite decision.

8. Consider the distribution of your troops (forces). All the forces concerned in the operation must be included in the order.

9. Formulate the order.

To comply with these requirements in a naval campaign order involves a careful study of the chart of the area under consideration. It will occasionally be found that unless this be done the contemplated movements cannot be executed. It may be possible that a reference to the sailing directions of the vicinity may be necessary.

The Tactical Signal Book prescribes the methods by which certain movements will be executed and is authority on distances, intervals and bearings in formation. By making use of the requirements of the Tactical Signal Book it will often be found that the orders may be shortened and still more often that detailed explanations may be avoided. If it should be necessary to vary from the Tactical Signal Book, it will follow that the contemplated movement must be prescribed in detail.

The commander is supposed to know accurately his own situation. In regard to the situation of the enemy he will be compelled to make allowance for unknown factors. The most usual error is to assume that the enemy is inactive. Really he is likely to do the very thing that may be most embarrassing.

The decision and distribution of forces is given in the problem posed.

FORMULATION OF A CAMPAIGN ORDER.

Every order must be logically arranged. Each order is paragraphed and all pertaining to the same subject must be united in the same paragraph. The most important matter appears first. In establishing a formation, as in a military march order, the forces are noted in the order of formation.

The order must be brief. Brief sentences are most easily understood. Conjectures, expectations, reasons for meausres adopted, detailed instructions for a variety of possible events, have no place in an order. Test the order to see if some superfluous word may not be omitted, or whether some shorter and more suitable expression may not be used. Rewriting an order is good exercise—it is rarely found that an order cannot be improved by consideration and rewriting. The acid test would be to rewrite the order and find it impossible to put it in any other form than that in which it was previously written. The final form should be such that for transmission it *must* be copied verbatim—to omit or to add a word would alter the meaning.

Orders should be clear and definite. Expressions depending on the view-point of the observer as right, left, ahead of, astern of, on this side, beyond, etc., are not admissible and compass bearings should be substituted. The terms *van, rear, right flank,* and *left flank* are applicable to portions of forces in formation but might not be practicable for use after contact with the enemy.

An order must be positive. The commander must accept the entire responsibility—there should be no attempt to divide it with his subordinates. If misunderstandings arise, the chief fault is considered to lie with the officer issuing the order. Such expressions as "attempt to capture," "as far as possible," "as well as you can," should never enter an order, and "according to circumstances" is a term absolutely prohibited. Do not use the terms "expect" or "presume," as the expectations or presumptions may not be verified, confusion ensues and subordinates lose confidence in the judgment of the commander. The more difficult the circumstances the more clear and positive must be the order.

An order must not trespass on the province of the subordinate. This is one of the most difficult requirements to be fulfilled and the most frequent of all errors, both in actual operations, and in the solution of problems. Great commanders have been guilty

of it habitually, and to it some owed their downfall. *The details of execution must be left to the subordinate,* who is probably better qualified to deal with them. It follows, therefore, that an order should not attempt to prescribe the method of operations too far in advance—a time limit is placed on the period which one compaign order is intended to cover. It is an error to extend an operation of an order so far ahead that in the meantime conditions may have entirely changed. Such orders must be recalled and others substituted and this is demoralizing. In practice it is usually possible for the commander to interfere if the attainment of the object in view is considered jeopardized, but there must always be urgent reasons for interfering with a subordinate's freedom of action. This applies more particularly to American psychological characteristics than to those of other nations.

It is possible that on occasions, for special purposes, and for reasons known probably to the commander alone, he may decide to give detailed instructions in regard to some particular matter. For instance, in establishing a scouting line, it will usually only be necessary to prescribe the scouting bearing and interval. The commander of the scouts will most likely conduct the scouting efficiently, at any event it must be assumed that he will do so. Still the commander of the forces may desire to hold the scouts to a certain line or he may wish to gradually advance or retire the scouting line. Or he may desire to make a special investigation of some port or island or vicinity in which case it would be proper for him to prescribe these details for the commander of the scouts. Again the personality of the commander receiving the orders may influence their character. The higher a commander, the shorter and more general may be his orders. In the final essence, however, the continuity of the whole, the unity of leadership, and the leader's own views and intentions outweigh all other considerations.

In every order particulars of time and place must be so carefully stated as to preclude any error.

Orders issued by subordinates should not be mere repetitions of those from higher authority with additions of their own. New orders are generally clearer and more satisfactory.

Arrangements for retreat are communicated confidentially to a few senior commanders only.

ORDER FORM.

Campaign Order No. ——
Name of Detachment or Force.
Name of Ship.
Location of Ship.
Day of Month, Month, Year, Time of Day.

FORCES.

(a) Name of subdivision.
Rank and name of Commander.
Composition of subdivision.
(b) Name of subdivision.
Rank and name of Commander.
Composition of subdivision.
(c) Name of subdivision.
Rank and name of Commander.
Composition of subdivision.

1. Information of the enemy, and information of our own forces, in the theater of operations, but under other command.
2. Plan of the Commander.
3. (a) The (name of sudivision "(a)" underscored) will .....
(b) The (name of subdivision "(b)" underscored) will .....
(c) The (name of subdivision "(c)" underscored) will .....
(x) Contains instructions in which all the subdivisions under paragraph three are equally concerned.
4. Orders or instructions concerning the train.
5. Where messages will reach the Commander of the whole force.

(Sig.) Name of Commander of Force.
Rank,
Commanding (Name of Force).

Copies to
Commanders of forces concerned.
How sent by (wireless, guard boat, aid, delivered in person, etc.).
Attest of delivery (for file copy).
Name, rank.

Alternative Form of Authentication:

By order of (C-in-C.)
Name,
Rank,
(Title of official acting for C-in-C.)

EXPLANATION OF FORM.

The heading follows generally the form prescribed by the Navy Department. "The name of the detachment or forces," and "the name of the ship" should be preceded by the name of the nationality, as "United States Scouting Detachment," "U. S. S. *Mohigan.*" If the ship is a flagship the word "*flagship*" should follow the name of the ship on the same line with it.

On the next line follows the name of the place at which the ship is; if at sea, the location by latitude and longitude.

On the 4th line is the date expressed in the order indicated in the form. The day of the month is given in figures. The month is written out. The year is indicated by the last two figures. The hour is noted to minutes and whether a. m. or p. m.

Example: "9 June 11, 10.15 a. m."

Times of "noon" and "midnight" should be written out.

On the left, one inch from the margin, and on the same line as "Location of ship" is "Campaign Order"; beneath it the number of the order.

The order begins without "Sir" or other form of address.

The first act in writing the order after the heading and numbering of the order is to write *"forces"* in the place indicated in the form. *"Forces"* enumerated in this form are those concerned in the order.

The subdivisions of *"forces"* are lettered. The subdivisions of the *"forces"* are those that the commander in his estimate of the situation decided were necessary and proper.

The forces are subdivided and named according to the functions they are to fulfill, and not according to the administrative or tactical organizations given in the fleet roster. In each case the name of the subdivision is followed on the next line by the rank and name of the commander of that subdivision and on the line following by the composition of the subdivision. This composition is indicated by squadrons or divisions if the subdivision is large, by single vessels, if the subdivision is formed of parts of divisions.

In a military order the subdivisions are arranged in order of importance; for instance, in an order of attack in the order of—artillery, main body, reserves, cavalry, engineers. If it is march order the subdivisions are arranged in the order of march, as—independent cavalry, advance guard, main body, signal troops, etc. In a naval campaign order they will be arranged in the general order of formation. When a subdivision is commanded by the commander of the whole force his name is omitted under the name of the subdivision that he commands in person.

A small interval is left on the right of the space occupied by *"forces"* and one blank line is left beneath this space. The remainder of the order is written on the available space.

Paragraph 1 contains: (1) Information of the enemy; then (2) of our own forces in the theater of operation, but under other command. It is conducive to clearness to separate the information of the enemy and the information of our own forces by paragraphing.

The information regarding the enemy will usually be very nearly a repetition of the conditions stated in the problem, though it is not always necessary to include all the conditions stated as they are primarily for the information of the officer writing the order.

It is preferable that each officer should give his own understanding of the case and not give a statement of the situation word for word. "Even when the commander, lacking satisfactory or exact knowledge, is unable to give definite information of the enemy, a statement of what seems to him most probable, based on the best information he has, deserves a place in the order, but it should be stated as a belief or probability, and not as a positive fact."

In Paragraph 1, and after the information of the enemy, is entered such information of our own forces other than those addressed which it is considered desirable for them to have. This should include information of any force whose action may influence in any way the operations of the forces included in the order.

Geographical names usually are found in this paragraph. Wherever these names are mentioned they must be printed unless they are clearly and legibly written. Such names should be written all capitals in typewriting. As an instance, in one of the problems last year BASHEE was not written in capitals and it became BASHU.

In a military order where geographical names enter to a great extent, it is a custom, where names are pronounced differently from the way they are spelled, to enter the phonetic pronunciation also.

Paragraph 2 contains a comprehensive statement of the general plan, sufficient to insure intelligent co-operation between the units of the command. "It is unwise to include too many details of the plan in orders, but it is essential to disclose sufficient to enable subordinates to conduct themselves intelligently." "It is always of importance that subordinates should understand the *object* of what is ordered, so they may strive to attain it them-

selves even should changes in the general situation demand on their part *different* action from that originally contemplated."

In paragraph 3 the duties of each group or subdivision of the forces are expressed in general terms, the details being left to the commander of the group.

Paragraph 3 is subdivided into lettered paragraphs, corresponding with the lettered subdivisions under "*forces.*" Each of these subparagraphs under paragraph 3 begins with the name of the subdivision concerned underscored, followed by the word "will" and then a statement of the duty of that subdivision.

In paragraph 3 will usually be found dates and times. These will invariably be spelled out in full. The only abbreviations allowed in the body of an order are "a. m.," "p. m.," "Lat.," "Long.," "N," "S," "E," "W," "G. M. T.," "L. M. T."

All numbers of whatever character except paragraph numbers that occur in the body of the order or under "*forces*" must be spelled out in full. Courses and bearings shall be given in degrees from zero to 360, and shall always be defined as "true" or "magnetic."

Paragraph (x) contains instructions that apply to all of the subdivisions under paragraph 3, such as course, fleet speed, renedzvous, etc. Methods of communication are usually referred to under paragraph (x).

Paragraph (x) is intended as a means of making the order brief, instead of repeating direction for each subdivision of the forces under "(a)," "(b)," "(c)," etc., of paragraph (3). All of these directions that apply to all of the forces are assembled and placed in paragraph (x).

Paragraph 4 contains instructions for non-combatant units, such as colliers, supply ships, repair ships, hospital ships, corresponding to the military train. "Train" is used to indicate all non-combatant vessels that accompany the fleet, in default of a better term.

After paragraph 4 are inserted any additional paragraphs found necessary.

In the body of the order the composition should be as nearly as possible independent of punctuation, in order to facilitate accurate transmission by wireless, if that should be necessary.

In the last paragraph, or in paragraph 5 if no extra paragraphs are found necessary, is indicated where messages will reach the

commander of the whole force. Usually it is sufficient to give the location or intended movements of the flagship.

The order is signed by the name of the commander followed on the next line by his rank and on the 3d line by the word "commanding" and the name of the forces which he commands.

If signed by the chief of staff or by an authorized subordinate of the commander-in-chief, the words "By order of the C-in-C" should be written under paragraph 5, followed by the rank and title of the official acting for the C-in-C.

Below the line giving the title of the officer signing and to the left is noted to whom the order is sent, and in the next line how sent.

On the file copy of the order is an attest of delivery with the signature and rank of the officer responsible for the delivery.

In transmitting an order by wireless paragraphs 1 and 2 are sent and then "*forces*" are sent, after which the remainder of the order is sent as written.

After having been carefully worked out the order should be copied neatly and legibly and signed. It will sometimes appear that parts of the order are superfluous, especially when transmitted by signal or wireless. For instance, the list of forces when all forces are present; paragraph 4 when there is no train—in this case write the paragraph number and leave the line blank; also when an order is sent from the flagship, and no shifting of the flagship is contemplated. It is considered best to follow the form strictly and to fill it out entirely, to make sure that nothing has been forgotten.

In framing a solution it will be found much easier to understand the principles on which the order is based than to apply these principles to the case in hand.

Appended is an acceptable solution of a problem in the formulation of orders.

PROBLEM.

Situation.—War was declared between Red and Blue 18 January, 1909. The main Blue fleet left Guantanamo on that date for the Pacific via Magellan Strait. The Pacific detachment under command of Rear-Admiral J— is at Seattle. This detachment consists of 6 B, 4 C, 5 V and 3 colliers.

On 10 February, 1909, at 9 a. m., Rear-Admiral J— receives information that a large Red convoy of transports with escort was

sighted at 6 a. m. 8 February, in Lat. 51° 30′ N., Long. 160° W., steaming eastward, speed about ten knots.

Rear-Admiral J— decides:

1. To proceed to sea with his entire force at noon with a view to attacking the red convoy.

2. To form scouting line of 4 C 50 miles in advance of main body with 25 miles between vessels.

3. To keep armored cruisers and destroyers together.

4. To follow great circle course from Tatoosh towards point where enemy convoy was sighted.

5. To send colliers to rendezvous sixty miles S. W. of Cape Disapppointment.

6. To appoint a rendezvous for combatant vessels 20 miles west magnetic of Tatoosh Island.

8. To use cipher "B" for wireless.

9. To remain in B-1 with main body.

The Pacific detachment is organized as follows:

Division Ten.
REAR-ADMIRAL J——
B-1, B-2, B-3.

Division Eleven.
REAR-ADMIRAL H——
B-4, B-5, B-6.

REAR-ADMIRAL J—— commands.

Division Thirteen.
CAPTAIN W——
C-1, C-2, C-3, C-4.

Destroyer Division Seven.
COMMANDER F——
V-1, V-2, V-3, V-4, V-5.

Required.—Orders issued by Rear-Admiral J—.

SOLUTION.

Campaign Order No. 1.
Blue Pacific Detachment,
Blue B-1, Flagship,
Seattle,
10 February 09, 9,30 a. m.

FORCES.

(a) Scouts.
Captain W——.
Division Thirteen.

(b) Main Body.
Division Ten and Eleven.
Destroyer Division Seven.

1. A large RED convoy of transports with escort was sighted at six a. m., eight February in Lat. fifty-one thirty N., Long. one sixty W. steaming eastward at ten knots.

2. This force will proceed to sea to attack the RED convoy.

3. (a) The *Scouts*, when clear of SAN JUAN DE FUCA Strait, will

maintain scouting line North true fifty miles in advance of *Main Body*. Scouting distance twenty-five miles.

(b) The *Main Body* will follow Great Circle route from TATOOSH to point where convoy was sighted.

(x) Get underway at noon. Standard speed fifteen knots. Use cipher "B." Rendezvous twenty miles two seventy magnetic from TATOOSH Island.

4. Train will proceed to a rendezvous sixty miles two twenty-five true from CAPE DISAPPOINTMENT.

5. B-1 will be with *Main Body*.

J.,
Rear-Admiral,
Commanding Pacific Detachment.

Copies to
Rear Admiral H——, Captain W——, Commander F——.
Extract to Colliers.
By Guard Boat.
QUILL,
Flag Secretary.

NOTES ON SOLUTION.

The heading and numbering of the order follow the prescribed form.

"*Forces*" are written in the space allotted. As division thirteen is to form a scouting line the vessels of this division may be called "Scouts" or "Screen." The "*Main Body*" is composed of the armored cruisers and destroyers, but no commander of the *main body* is mentioned under "*forces*" as Rear-Admiral J—, the detachment commander, commands the main body.

In paragraph 1 is information of the enemy. This is complete, as the nature of the expedition requires that each unit have the fullest possible knowledge of the situation. Paragraph 1 contains no information of own forces as all such forces, under other command, are too remote to have any bearing on the contemplated movement of the Pacific detachment.

In paragraph 2 is a brief, comprehensive statement of the plan. "It is unwise to include too many details . . . . It is always important that subordinates should understand the object of what is ordered." This general statement of the plan is intended to further intelligent co-operation of the forces.

In paragraph 3 are the instructions for the subdivisions. These instructions do not carry the plan beyond the first hostile contact. Rear-Admiral J— wisely decided to await that contact and then

adjust his further plan to the situation then obtaining. It would be desirable for Rear-Admiral J— to formulate plans of action to fit possible situations resulting from hostile contact if there were sufficient data available on which he could base such plans. As, however, he is not informed of the strength or disposition of the escort he is compelled to await further information.

The remainder of the order needs no discussion.

Some officers may think the tactical dispositions faulty, the decisions of Rear-Admiral J—, as stated in the problem, unsound, but such questions are not involved in the solution. The problem is to embody the decisions of Rear-Admiral J— in a clear, brief order arranged in logical sequence in accord with the spirit of a form that has been found by experience suitable.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ORIGIN OF OUR SIGNAL BOOK.*

By LIEUT.-COMMANDER RALPH EARLE, U. S. Navy.

In order to give the origin of our present signal book it is necessary to mention briefly the lives of the English commanders and the conditions under which they developed it.

For our Revolutionary War, England was thoroughly unprepared principally through her own mal-administration. In Europe all her old time enemies seized this opportunity to injure her by throwing in their lot with America and thereby possibly gain some advantage to themselves. Thus England was hard put to provide ships and men for her navy on the coast of America.

Lord Richard Howe, who was born in 1725, became an admiral in the English Navy when the Revolution broke out, and was appointed to the command of the insufficient naval forces operating in America against the colonies. Despite the far more powerful French fleet of Count D'Estaing, he relieved Philadelphia, later frustrated the French attempts on New York and Newport, and compelled the French to sail for the West Indies. Yet he never in this campaign won a single victory.

While busy with this task he started the compilation of a signal system.

At this time, the English Navy, though suffering reverses on all sides, was the best and most efficient in the world, yet its signal code, and probably the codes of all nations, was certainly very crude.

All information and directions to commanders of ships as to how to act in battle were at that time contained in the *Fighting Instructions*. This code originally contained less than 20 maneuvers, and to signal these was a comparatively simple matter. The complete signal code was composed of these five

* All the information in this article is taken from *Sea Kings of Britain*, Vol. 3, by G. A. R. Callender, B. A., of the Royal Naval College, Osborne, published by Longmans, Green & Co.

flags, one red, one white, one blue, one yellow and the union jack. The one requirement stipulated in those days for signals, that they be instantly recognized when hoisted, was thus obtained. To make more than five signals the flags were used in this way: Each flag meant a single message, but the particular message depended on the place where it was hoisted; thus, the fore truck, main truck, mizzen truck, spanker gaff and after flag staff were used as places for hoists, and thus these five places and five flags gave 25 possible signals.

Lord Anson, when first lord, however, had authorized the issuance of additional instructions, and thus it came about that there was no means of signalling them, and confusion became the order of the day.

A sample page of the famous *Fighting Instructions*[1] is reproduced herewith.

Number.	Fighting Instructions.	Flag.	Where Shown.
I	Line ahead.....	Union Jack.....	Mizzen-peak.
IX	To go about beginning with the van..	Union Jack.....	Fore-top.
X	To go about beginning with the rear..	Union Jack.....	Mizzen-top.
XIII	Battle.....	Red.....	Fore-top.
XVI	Fill sails and carry on.....	Yellow	Fore-top.
XVII	After passing the enemy on opposite tack, to go about all together.	Union Jack.....	Fore-top and at mizzen-top.

Number.	Additional Fighting Instructions.	Flag.	Where Shown.
XV	*Hawke's Quiberon Maneuver.*—To chase, and leading ships to form while chasing.	Red with white cross.	Main-top.
XIX	*Vernon's Maneuver.*—Closer action.	Half blue, half white.	Fore-top. N. B.—Under "Battle Flag."
XIV	*Hawke's Finisterre Maneuver.*—When in chase to pass on disengaged side of those already engaged.	Dutch Flag.....	Main-top.
XXVI XXVIII	*Rodney's Martinique Maneuver.*—To mass attack on a part of the enemy's line.	Spanish Flag.....	Fore-top.
XXXV	*Rodney's "12 April" Maneuver.*—Cutting the enemy's line.	Blue and yellow chequer.	Fore-top.

These were compiled in a hopeless muddle, no system, no beginning, end, or method whereby a signal's meaning could be determined save by a frantic hurried search through many pages.

[1] From *Sea Kings of Britain*, Vol. III.

Lord Howe originated and completed the compilation of the first signal book while still in command in America. His arrangement of subject matter was this: A page was devoted to the use of each flag. On each page was arranged the several meanings that the flag of the page might have.

Lord Howe returned to England in the fall of 1778 to find an entirely unsympathetic and unappreciative populace, the insults of which impelled him to retire from the service in a manner similar to Lord Keppel.

We remember that Lord Keppel, one of England's greatest admirals, at Ushant in July, 1778, doing his best, which means he did wonders with an inferior force, was unable to make the fight a decisive victory, and because of this was court martialed but most honorably acquitted. He felt, however, that as the ministry in power had put him on trial for his life he could not again serve under them, and so he resigned, thus leaving the direction of affairs in the Channel without a head.

Lord Howe, on his retirement, turned over his signal book to his friend, Captain Richard Kempenfelt, then senior officer in the Channel, no successor for Keppel having been appointed.

Kempenfelt was interested and enthusiastic in this work and determined that the whole system of the *Fighting Instructions* should be abolished because of their utter inefficiency.

A study of the early battles fought under these instructions show one that all the victories would have been made more complete and defeats less disastrous if a signal code had existed. For example: if Lord Keppel at the Battle of Ushant, July 27, 1778, could have made his point of view known to Sir Hugh Palliser of the *Formidable* the result would have been a glorious victory in place of an inconclusive fight; Rodney's strategem and the completeness of his success at the Battle of Martinique, April 17, 1780, was ruined by Carkett in the *Stirling Castle* leading the van, who incorrectly interpreted the construction Rodney wished placed on Instruction XXI, and Rodney on account of defective signal methods was unable to impart his commands to the erring commander.

Kempenfelt at work on Howe's signal book invented or evolved the *Numeral Code,* deriving possibly some assistance from French sources, which, however, no one but himself would have troubled to study. He used 16 flags, and each flag was al-

lotted a page in the book. The significations were not sorted out under each flag. The flags signified 16 numerals (1 to 16). Each was used in turn to give a page its numerals and on each individual page the whole 16 were grouped again, thus allowing of 16 entries per page. The masts or locations in which a flag was hoisted no longer formed a part of the code. Two flags were required in each hoist, and the message conveyed was thus interpreted: A hoist of 8 and 14 was read by turning to page 8 and reading entry number 14. The combinations possible were thus 16 times 16, giving 256 possible signals logically arranged and quite easily found.

So Kempenfelt at last laid the foundation for the present signal codes in use by the navies of the world. Nelson without this signal system would have been nearly helpless at Trafalgar, while with it at Martinique Lord Rodney could have prevented Carkett from ruining the hope of his life.

In 1782 the administration changed, Lord Keppel becoming first lord of the Admiralty, and Lord Howe was at once called from his retirement and placed in command of the Channel Fleet. Here Kempenfelt was chosen as his flag captain, and together the two officers issued the *Signal Book* in its earliest working shape.

Kempenfelt was unfortunately drowned when the *Royal George* sank at her moorings in Portsmouth Harbor on August 29, 1782.

During the next twelve years Lord Howe left thus without his able co-worker carried on the work, amending, correcting, improving the code, but above all getting it recognized and adopted in the fleet. The signal success of all his campaigns and his final victory completely popularized the *Signal Book* with the service.

Lord Howe's remarkable career had its greatest victory in his defeat of the French in 1794 at the battle known as the "Glorious First of June." Then after he had calmed the famous mutiny of 1797 he was allowed to retire from active service. He died in 1799.

This article serves to indicate the condition of signals at the time of the Revolution, each captain being apparently compelled to work out his own, and as giving one of these codes the article which follows on the signal system of Samuel Barron may be of interest.

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neatly executed I take pleasure in submitting the work of this forgotten and unknown midshipman of long ago to his present brethren, the officers of the United States Navy.

SIGNALS ADOPTED BY THE COMMANDER OF THE U. S. S. GEORGE WASHINGTON IN 1799.

SIGNALS BY DAY

For all Captains to come on board the Commodore A Dutch Ensign
For the fleet to weigh and make sail out of the Harbour
A Portugues Ensign
For the sternmost Vessels to make all the sail they can
A French Ensign
For the fleet to make the best of their way close to the wind
An English Ensign
For the fleet to make the best of their way large or from the wind
A Spanish Ensign
For the fleet to observe the motions of the Commodore & attend to them *An American Jack*

Should any of the fleet be in distress and not able to keep up with the Commodore, they will hoist their Ensigns at the Maintop Gallant or Topmost head—

If any of the Fleet wants to speak the Commodore he will hoist his Ensign at his Foretop Gallant, or Topmast head—

Should any of the Fleet discover a strange sail, he will haul up his Foresail, lower his light sails and hoist his Colours—

For the fleet to keep close to the Commodore, he will hoist a white Flagg—

For the headmost Vessel to heave to, to let the sternmost come up *.A Red & white Flagg—*

SIGNALS BY NIGHT

Should any one of the fleet discover a strange sail, he will hoist a Lanthorn in the best place to be seen & fire a Gun, if he has one—

The fleet will be careful not to go ahead of the Commodore, as he will carry an easy sail all Night that the slow sailing Vessels may keep up—

The Fleet will be very careful to keep close together—

Should any of the fleet either by day or by night run ahead or keep at such a distance as the Commodore thinks imprudent, & he has occasion to fire a Gun, they are to observe for every Gun he

fires he will make the offender for the first pay two Dollars, the second three & all after four—

If the Fleet is to shift for themselves the Commodore will hoist two lights, one over the other & if convenient fire a Gun

The Commanders of Merchant Vessels will please to pay the strictest attention to the signals as it will be the means of expediteing the Convoy, & to take care to destroy them in case of Capture

On Board Geo. Washington Prince Ruperts Bay
Feb^y 1^st 1799—
Pat^k Fletcher

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

HIGH PRESSURE TURBINE PUMPS.*

By LIEUT. (J. G.) V. V. WOODWARD, U. S. Navy.

In the present day the rotary principle of the turbine seems to be the ideal taken for the motion of all primary machines, and the reciprocating principle is gradually losing its prestige in the mechanical world. In no field has the rotary principle experienced such marked success in the last few years as it has in that of high lift or high pressure pumping, although the realization of its possibilities for such duties is perhaps older than that of the steam turbine itself. The present use of the turbine pump has extended into such a wide field that it is difficult to find services to which it cannot be advantageously applied.

It might therefore be of interest to take a few moments to trace the development of machines of this design, beginning in the early part of the eighteenth century when the first crude machine that conceived the turbine idea was brought into use. This rotary contrivance was for the purpose of raising water from a lower to a higher level, and it is the forerunner of pumps of the turbine type. This pump was designed and built by a Frenchman, and consisted of an inclined tube made fast to a vertical shaft by arms, the lower end of the tube being immersed in a pool of water to be raised to the higher level. When the shaft was revolved in the proper direction the water was lifted up and ejected from the top of the tube, the height the water reached depending upon the velocity of rotation of the shaft. Fig. 1 shows a rough sketch of this crude pump. The driving power was probably transmitted to the shaft by means of a belt and pulley.

About the same time another Frenchman devised an improve-

* A lecture delivered before the School of Marine Engineering, Annapolis, Md., April 8, 1912.

ment in what was known as the Hessian Bellows so that they might be applied to both "wind and water."

NOTE.—From the little information obtainable on the Hessian Bellows, I would take it to be a rotary contrivance of some sort used for the ventilation of mines. It is interesting to note here the development of the centrifugal pump made in one step, that from the crude machine shown in Fig. 1 to the paddle wheel impeller type shown in the Hessian Bellows. The impeller as used today is the same as that of the Hessian Bellows, except that modern developments have introduced curved blades.

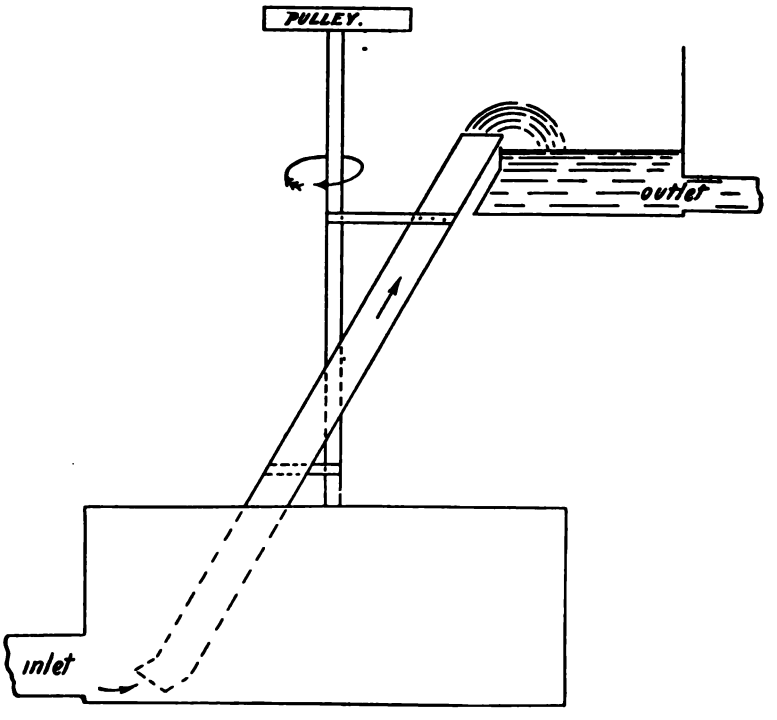


FIG. 1.

The Frenchman's improvement in this ancient apparatus consisted in enclosing his radial wings or paddles in a cylindrical chamber, the portion of the chamber around the periphery of the wheel being spiral in shape. The drawings of this machine show clearly the volute casing of the modern centrifugal pump. At the time of the completion of this fan machine there was no means of driving it other than by hand, so that it was about a century later, when steam motive power came into existence, before the ideas were carried out in actual practice.

In the past, centrifugal pumps were considered by engineers, and accepted by them, as being a suitable means for easily and cheaply raising water to low heads. Further than this they were useless. It was not realized that they were capable of dealing with high heads or pressures, in fact, this idea became the generally accepted rule in engineering practice and it took many years of strenuous effort on the parts of the deeper thinking engineers to remove it. It is shown, however, by the patents of one Gwynne, an Englishman, that the above rule was not altogether universal. Included in his patent papers is the design of a series or multiple stage centrifugal pump with four wheels. This patent is the first proposal on record for the use of the centrifugal impeller in series, and though the form of his impellers (being flat or radial like a paddle), and his pump having no guide vanes in the casing, would prohibit it from having even a low efficiency with the heads dealt with to-day, still it shows the conception of a machine quite a good deal in advance of the times.

Although the water turbine with its vanes was a matter of common knowledge at this time, there appears to have been no attempt made to reverse its action for the purpose of raising water under higher heads and with a corresponding high efficiency. It was not until about 1825 that an invention did embody the reversal of the turbine action for the accomplishment of the above mentioned purpose. This consisted in incorporating the curved vanes of the turbine in the casing of the pump, the vanes being so shaped that there is an easy conversion of the kinetic energy of the water leaving the impeller blades, into pressure in the pump casing. The first turbine pump developed along these lines was used in the Navy Yard, New York, in 1830. Since that time the pump has developed rapidly and has finally reached the stage of the pressure turbine pump which is being used at the present time for boiler feed and other duty requiring high lifts.

A centrifugal pump is exactly the reverse of the turbine wheel. In the turbine the water approaches the wheel with a high velocity and in a direction making a small angle with the direction of motion of the circumference of the wheel, and thus the water has a high velocity of whirl which it imparts to the wheel. When the water leaves the wheel its velocity is small and the velocity of whirl should be zero. In the centrifugal pump these conditions are entirely reversed; the water enters the wheel with a small velocity

and leaves it with a high velocity. If the casing surrounding the wheel admits of this velocity being diminished gradually, the kinetic energy of the water is converted into useful work, but if not, it is destroyed by eddy motions or currents in the casing, and the efficiency of the pump is accordingly low.

The simplest form of the centrifugal pump is one in which the water enters the impeller wheel at the center, either under head or by vacuum produced by the rotation of the impeller, the water then gradually acquires the velocity of the impeller as it proceeds towards the ends of the blades and it is finally thrown off into some whirlpool chamber which encases the impeller. Suppose the velocity of water leaving the impeller blades be v feet per second, then as each pound of water leaves the impeller the reaction retards the impeller with a force $\frac{v}{2g}$, this force multiplied by v $\left(\text{which equals } \frac{v^2}{2g}\right)$ is the kinetic energy per pound of water received per second from the impeller. This energy is gradually changed into pressure in the whirlpool chamber, and by the time the water reaches the delivery pipe it has a sufficient pressure to force it up the pipe. The efficiency of the pump depends primarily upon the curvature of the impeller blades and upon the shape and size of the whirlpool chamber with its guide vanes. The theoretical height to which a pump will raise water is given by the familiar formula $v=\sqrt{2gh}$ (the velocity acquired by a body falling from the height h). In the case of the pump v would be the velocity of the periphery of the impeller and h would be the height to which the water would be raised by an impeller turning at this velocity. In actual practice, however, the height h is reduced somewhat by friction losses and eddy currents.

It has been proved experimentally that water cannot pass along a path of suddenly changing curvature without loss of energy, and this loss will become greater the greater the velocity of the water. Upon this fact depends the designing of machines like centrifugal pumps and turbines which act upon or are acted upon by water. If water be compelled to flow along a pipe which suddenly changes in diameter, it produces in itself little whirls or eddies which act like wheels to help it around the corners, just as rollers under a log help the log to be moved more easily. But wherever such eddies are set up energy is wasted, not only around the corners but by the smaller

eddies which are set up and carried along by the water. Suppose we make the water flow along the pipe shaped as at A in Fig. 1a, there will be eddies set up carrying the water around the curvature from A to C. If the water flows along a curve at N and it is made to pass around a similar curve at M, you do not experience as much waste of energy in the second curve M as you did in the first at N; but if the water first pass along a curve at R and then around a curve at S, similar but bent in the opposite direction, you will get fully as much waste at S as you did at R. The little eddies created at N are available at M but those produced at R

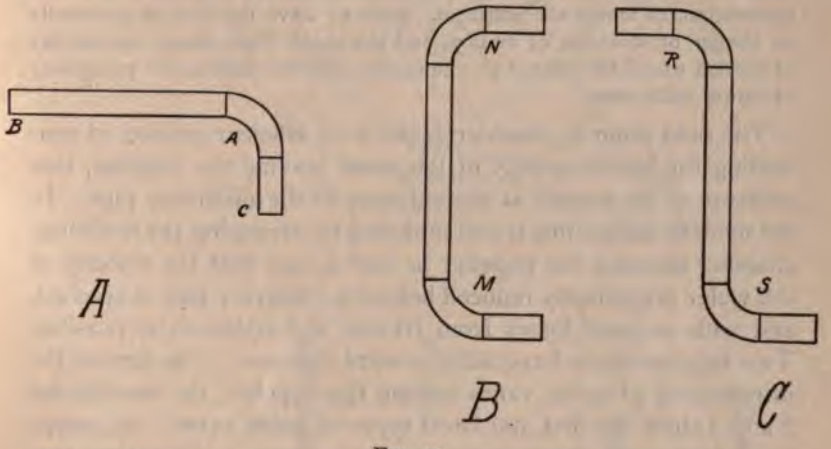


FIG. 1A.

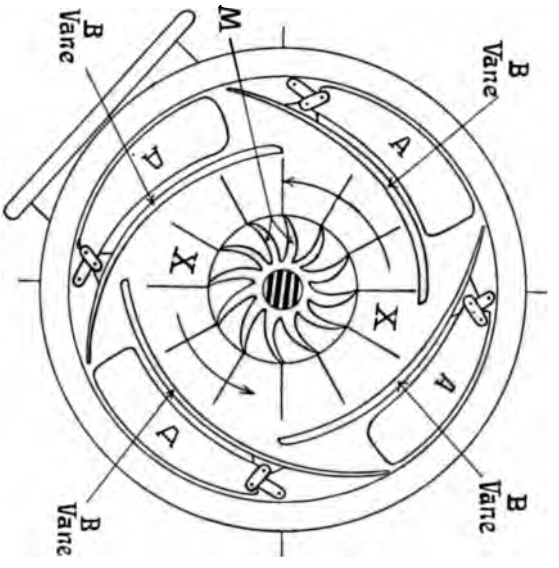
have to be destroyed and new ones created rotating in the opposite direction in order to carry the fluid around the curve at S.

It is evident then that in order to reduce the loss of energy as much as possible, great care must be exercised in designing a centrifugal pump or turbine; to provide for the water a path free from abrupt changes in direction. The angles for the vanes and any other guiding surfaces must be properly determined and placed so that the water may pass into and out of the impeller without sudden change in direction or velocity, and all curves should have a gradual change such as would be obtained if we could use an elastic material of some sort in the place of the metal used in the construction of the pump. It is most important that the angle of the base of the impeller blad uch that the water will not receive shock on ent and the direction of

flow must be as nearly as possible the same the instant after entering the impeller as it was the instant before entering. This fact is clearly illustrated by a simple analogy as follows:

Take the case of a swiftly moving vehicle of any kind, such as a street car. We wish to board the street car while it is in motion. It is almost a certainty that you would hardly find a person who would wait until the car had arrived opposite him, and then throw himself in a line at right angles to the motion of the car upon the platform. If the car were moving at all rapidly, the shock resulting from abrupt change of direction of motion would most probably result in serious injury to the person. The logical method of boarding the car would be to run alongside for a few steps in the direction the car was moving, and after gaining sufficient momentum, to mount the platform. Now we have the case of practically no change of direction of motion, and the shock from change of velocity of motion would be reduced to a minimum, thereby making the probability of injury quite small.

The next point to consider is the most efficient method of converting the kinetic energy of the water leaving the impeller, into pressure to be exerted at the entrance to the discharge pipe. In the modern design this is accomplished by arranging the discharge chamber incasing the impeller in such a way that the velocity of the water is gradually reduced before the delivery pipe is reached, and with as small losses from friction and eddies as is possible. Two improvements have aided toward this end. The first is the introduction of guide vanes around the impeller, the two figures 2 and 3 show the first and latest types of guide vanes. In pumps fitted with guide passages or vanes, the water is discharged into a certain number of narrow channels distributed around the circumference of the impeller, these channels diverging outward. The vanes are generally cast in the section of a hollow cylinder which fits around the impeller. Its inside circumference is carefully machined to make a smooth running fit with the impeller. As will be seen from Fig. 3, the modern guide passages are so shaped that the entering angle from the impeller will be the same as the angle at which the water leaves the impeller blade tips. The vane passages work on the familiar theory of the Venturimeter, *i. e.*, the whirling velocity of the water from the impeller gradually decreases and the hydraulic pressure gradually increases as the ends of the passages are approached. If the vanes are carefully and properly designed the total energy of the water, minus friction and eddy losses, will be converted into pressure by the time the water has reached the whirlpool chamber, the velocity


B
Vane
M
B
Vane
A
A
A
A
X
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B
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B
Vane

FIG. 2.

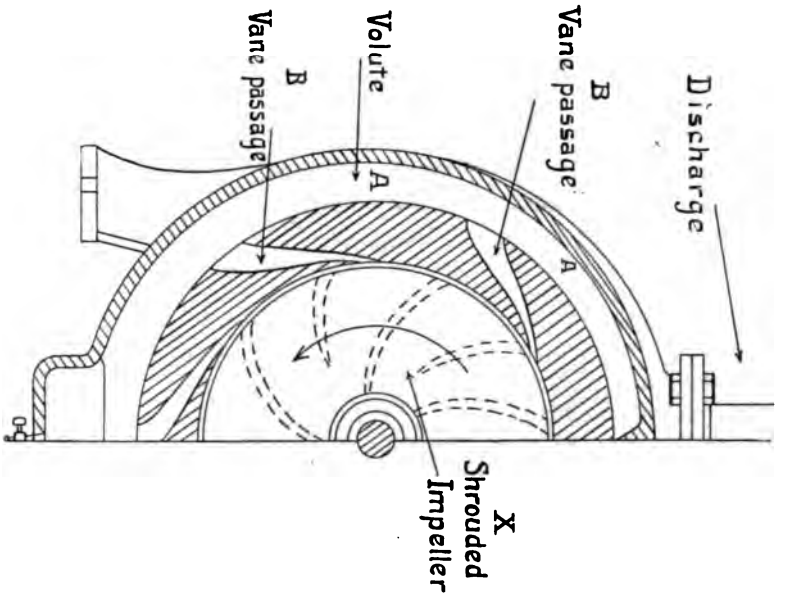

Discharge
B
Vane passage
Volute
B
Vane passage
A
A
X
Shrouded
Impeller

FIG. 3.

at this point being as low as six feet per second in an efficient pump. The vanes must not be too short as this will not allow of sufficient length for the proper conversion.

Referring to the figures: In Fig. 2 the water enters through the eyes of the impeller M, and is thrown from the blade tips against the curved surface of the vanes B which in this old type was made adjustable. After passing through the passages between the guide vanes in which part of the velocity of the water is trans-

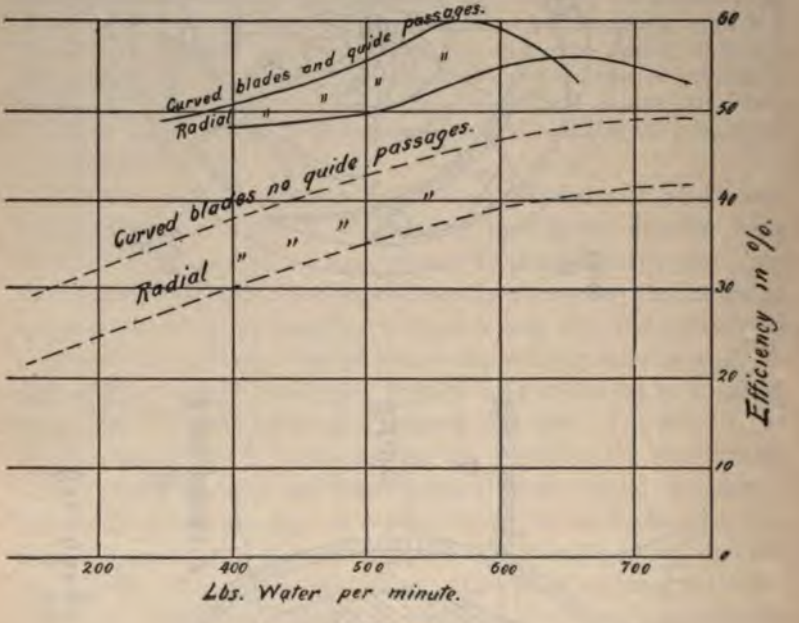


FIG. 4.

formed into pressure the water passes out into the discharge through the openings AA. As will be seen from the sketch, the crude shape of these first constructed guide vanes was such as to prevent an efficient energy pressure conversion.

In Fig. 3 we have an example of the modern pump with its vane passages. X is the shrouded impeller which throws off the water into the efficiently shaped vane passages B, in which there is almost total velocity pressure conversion. After passing through B the water enters the volute chamber A where there is a further small velocity pressure conversion.

A late design of the diffusion vane plate or diffuser has been along the lines of reducing friction, since this has been the purpose of designers after having perfected a suitable method for the energy pressure conversion. Professor J. Novak, of Austria, has designed a pump with rotating diffusers. In this pump the diffusers or vane plates have passages similar to those in the ordinary pump, but the plate is free to be rotated upon the shaft of the impeller. As a result of this arrangement there is a decided advantage; *i. e.*, reduction of the water friction on both sides of the impeller. The new diffuser consists of one or more shells rotating separately. These, as stated before, are so shaped as to form an easy passage from the impeller to the volute. The diffuser shells revolve freely on their axis and the water discharged from the impeller keeps them in motion. It is easily seen then, bearing in mind the rotating diffusers, that the ratio of velocity existing between the water and the revolving diffusers is much less than that produced by the stationary diffusion vanes ordinarily used, and with this reduction in the relative velocity there is a very appreciable lowering of friction losses. Professor Novak gives an increase in efficiency of the rotating diffusers over the stationary diffusion vanes of 20 per cent. This figure is the result of numerous tests conducted by himself.

Fig. 4 is interesting, showing the efficiency of a pump with and without vanes.

THE VOLUTE OR WHIRLPOOL CHAMBER.

The suggestion of one authority on hydraulics, that the water leaving the impeller should be discharged into a chamber in which a free spiral vortex could be set up, thereby converting the kinetic energy of the water into pressure, has been adopted by all designers of centrifugal pumps. In Fig. 5 consider the casing that is concentric with the impeller, practically the whole of the kinetic energy is destroyed by the eddy motions of the water and the efficiency of pumps having such a casing is generally much less than 50 per cent. In this type the water area of the chamber around the impeller is constant, and therefore the velocity will continually increase as the delivery pipe is approached. There will be streams of water from the impeller impinging with streams of different velocities in the chamber, and there will be large losses from the resultant shock. A particle of water leaving the

impeller at the top of the casing has a certain velocity, by the time it has reached the bottom of the casing the velocity of this particle has increased, due to constant area of chamber, but the water coming off the impeller at this point (the bottom), has the same velocity that the first particle originally started with, hence it can be readily seen that as the particle with the high velocity strikes the particle with the low velocity that there will be shock, which as stated means loss. Also there is a large loss from eddy currents, for the reason that as we proceed from the top of the impeller around to the discharge, the volume of water is constantly increasing and there has been no allowance made for it by gradually

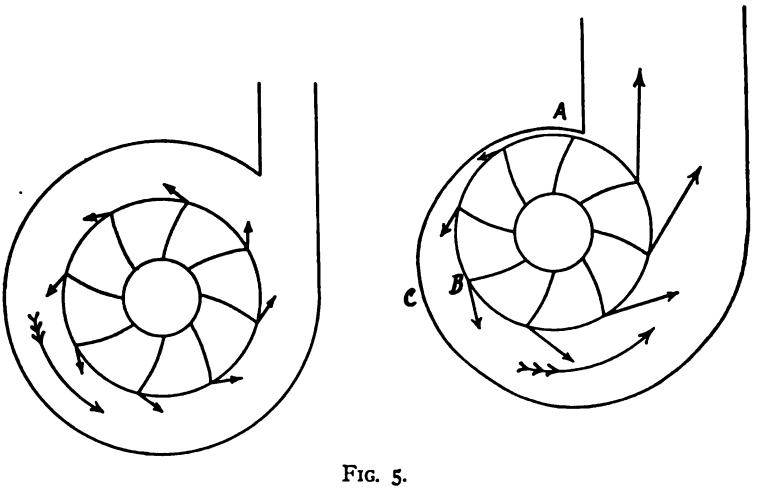


FIG. 5.

increasing the volume of the chamber. The effect of this is to set up small whirls and back currents.

In order that there shall be a minimum waste of energy in the whirlpool chamber the water must follow a law known in hydraulics as the law of natural flow, *i. e.*, the velocity of the water traveling in a spiral path varies inversely as its distance from the center of the spiral. Hence the adoption of the spiral chamber or volute. It can be seen from the second sketch in Fig. 5 that as the water progresses toward the discharge pipe its spiral path takes it farther from the center of the impeller with the proportionate decrease in the velocity. In this instance the impeller is eccentric with the casing, and at the top the impeller makes a close fit with the casing. Since the impeller discharges uniformly

all around, the area of the section between the casing and the impeller at any point, say at BC, is made proportional to the volume of water discharged from the wheel between the point at the top and the point half way down BC. That is, the width of the chamber at BC will be proportional to the water discharged from the impeller between the point A and the point BC. The sketch shows a casing which will satisfy this condition. In construction the casing is widened out perpendicular to the paper intead of laterally. This form (the gradually increasing area of water space) permits of a uniform velocity around the casing and consequently there is very little loss of head from the shock of water of different velocities impinging on each other, as was the con-

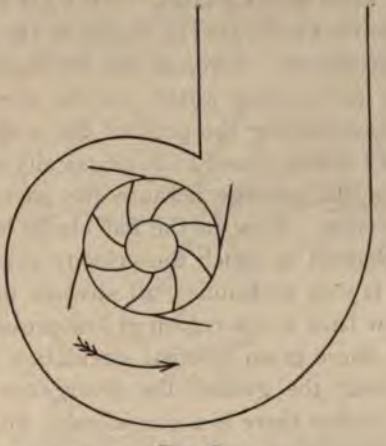


FIG. 6.

dition in the first type of chamber. Before the introduction of guide vanes the above casing was the type used on all pumps, it is called a volute. The same casing is used in the design of all modern pumps except that the guide vanes are introduced and the impeller is not placed quite so near the top of the casing. Fig. 6 shows a line sketch of the casing with the guide vanes installed.

THE IMPELLER.

Another important point in the design of the centrifugal pump is the curvature of the blades of the impeller: the blades being either flat (radial), backward curved, *i. e.*, curving away from the direction of rotation of the impeller, or forward curve, *i. e.*,

curving toward the direction of rotation of the impeller. It has been proved that the efficiency is considerably less with the flat and forward curved blades than with the backward curved blades, and for this reason and others mentioned later the impellers of all modern pumps are of the backward curved type.

From experiments conducted on two seven inch impellers, one with flat blades and the other with the backward curved blades, it was found that the efficiency of the latter over the former was about 8 per cent, and remained constant at all points of the revolution quantity curve, and the horsepower applied to the shaft was about 22 per cent less in the case of the backward curved blades. We can assume, and the assumption is a true one, that the friction loss of the water is the same in both cases. We must then attribute the superiority of the backward curved blades to the small amount of slip or internal circulation. Suppose that the impeller is at a standstill and that we are forcing water into the eyes under pressure of some sort. Considering the path of the water in the curved blades the velocity will be found to be practically uniform throughout the length of the passage because the passage is of almost uniform cross section. Now in the flat blades we have the case of a diverging channel in which the velocity gradually decreases. According to a law of hydraulics, all streams in a channel have a tendency to flow back to the region of low pressure from whence they came, *i. e.*, there is an internal circulation or back flow set up which is greater the greater the divergence of the channel. A result of this is that there is a considerable loss in energy, and going on the assumption that this back flow does take place in the channel between the flat blades, it is evident that the work absorbed will be greater when this circulation does not take place, as is the case with the backward curved blades. This is the chief reason for the greater efficiency of the backward curved blades (*i. e.*, the very much less divergence of the channel between them), and leads to the conclusion that for maximum efficiency the blades of the impeller should be so designed that the velocity of flow through the impeller is practically constant. This, of course, refers to the impeller at a standstill; when running the water in the channels would gradually increase in velocity as it approached the ends of the blades, due to the centrifugal force of the rotating impeller, which is the object sought, and is a condition that must exist. The curves in Fig. 4 show the efficiency in the two types

of blades. Figure 7 is self explanatory and shows what is meant by the different types of blades.

One of the advantages of the backward curved blades is that it is possible to vary the amount of water discharged by varying the speed of the impeller, whereas this is not possible, to any appreciable extent, with the flat or forward curved blades. With flat or forward curved blades the kinetic energy of the water as it leaves their tips is very much greater than in the case of the backward curved type, and this energy is so great that an enormous volute would have to be constructed in order to allow of the energy being converted into pressure. The prohibitive size of the volute required is one reason for not using this type of blade. Also the great stress set up on the volute casing by the centrifugal force of the discharged water would require the casing to be made of

FIG. 7.

infinitely strong and heavy material, the requirements in this case being such that they could not be fulfilled mechanically. There is one case on record of a test of a specially constructed pump of very small dimensions using flat blades and working against a lift of 350 feet, where the pressure in the volute casing due to the centrifugal force was 7250 pounds per square inch.

The use of the backward curved blades allows us to use a casing of small dimensions, due to the small value of the kinetic energy of the water leaving the impeller, their use also gives us very much better efficiency for the reason that the losses due to the shock of water on entering and leaving the impeller are greatly reduced over that experienced in the flat blades.

All impeller blades are now made shrouded, *i. e.*, the wheel is made with two flat faces and the blades are set down between the faces, or better the blades are cast with the wheel. The open impeller, that is, the paddle wheel type, not only gives rise to ex-

cessive friction due to the contact of the rapidly moving water in the impeller with the stationary pump casing, but eddies are set up between the edges of the impeller and the casing. The shrouded or inclosed impeller is not subject to these losses, as the retaining shrouds or side plates revolve with the blades and with the contained water. The blades of open impellers must run close to the pump casing in order to prevent leakage. This trouble is not present with the shrouded impeller, which can run with a reasonable amount of clearance, although for the best efficiency this should be as small as possible. Most impellers are made of bronze, the metal best adapted to withstand the action of water and retain their original shape and smoothness. Bronze also takes a high polish and permits of more accurate castings being made. Impellers are all hand finished, inside and out, polished, and then balanced at a high rotative speed.

Experiments have shown that blades not shrouded give losses from the side friction of the water on the casing of from four to five times that of the shrouded blades.

As water passes through the impeller at relatively high velocities, any irregularities on the surface will be highly wasteful of energy. The losses on the outside of the impeller are due, in the greater part, to eddy currents, and their amount, besides depending upon the nature of the surface, increases as the square of the velocity at which the impeller travels. To generate a given pressure or head, the periphery of the impeller must run at a certain definite velocity. Then a square inch of the outside surface of the impeller will meet a certain resistance as it revolves, which multiplied by the impeller velocity will give us the rate at which energy is being wasted. Therefore, of two pumps generating a given head, the larger diameter impeller will have a greater number of square inches of surface moving at any given velocity and will therefore waste more energy. The surface of a circle varies as the square of the radius so that the external impeller friction for a given head varies as the square of the radius of the impeller. It is at once clear that the smaller we can make our impeller for a given duty the more efficient will be our pump. Hence all designers of modern pumps make their impellers as small as is possible and yet do the work required of them.

A short explanation of an item mentioned in the early part of the paper. In practically all cases of discs or wheels rotating in water, the resistance to motion is smaller the less the clearance

between the moving part and the sides of the vessel in which it is contained. Therefore all side and end clearances of the impeller should be cut down to a minimum; also the casing and impeller should have machined and polished surfaces. From experiments made on several twelve inch impellers it was found that a rough cast iron impeller revolving in a rough cast iron casing absorbed 2.9 horse-power at 2000 r.p.m. with a side clearance of ⅝-inch, while the same impeller in the same casing, but painted, absorbed only 2.0 horse-power. As stated, the efficiency of the open bladed impeller is very small compared to the shrouded impeller, and very large clearances will decrease this efficiency still farther. As an example: the side clearance of a four bladed open impeller (rough) was increased from ¼ to ½-inch. In the first case the resistance was 3.6 times that of a polished impeller, while in the second case it was 4.7. The above illustrates clearly the necessity of perfect castings, free from all blow holes and other imperfections; also the importance of small clearances and smooth and highly polished impellers and casings.

As will be seen later on, the use of shrouded impellers gives us a means of taking up the end thrust experienced in high lift pumps.

END THRUST.

Due to the side pressure on the impeller caused by the entering water striking it under pressure, there results an end thrust on the shaft of the pump which is not balanced by the water leaving the impeller at the periphery. In the single stage pump the thrust is very small and is taken up either by the use of a small thrust bearing on the end of the shaft or by the use of a twin volute casing. This design of casing permits the water being taken in at both sides of the impeller, thereby making the thrust on one side equal to the thrust on the other side. The twin volute is shown in Fig. 8.

The thrust bearing needs no explanation.

The end thrust in the series pump is taken up in four different ways: (a) by means of a thrust bearing; (b) by placing the impellers back to back, Fig. 9; this method requires the water to follow a most tortuous path from one stage to another and consequently is used in two tage pumps only; (c) by cutting a small hole in the impeller near the boss allowing the water to get on the back side of the impeller thereby equalizing the pressure, this can be

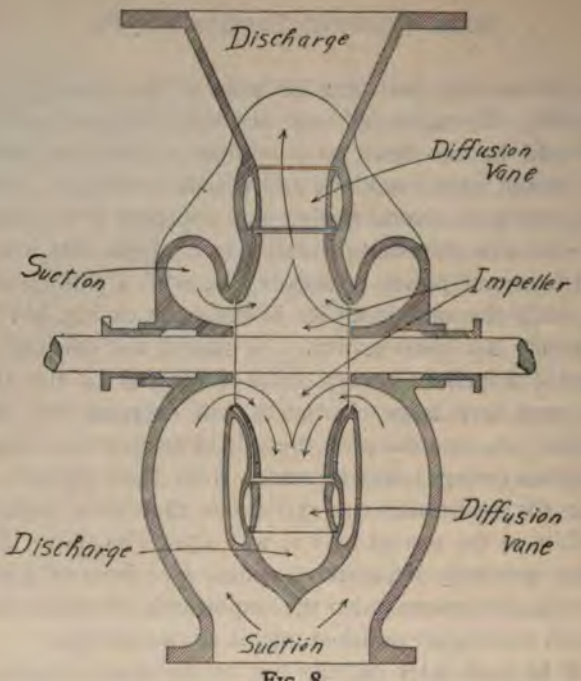

Discharge
Diffusion Vane
Suction
Impeller
Diffusion Vane
Discharge
Suction

FIG. 8.

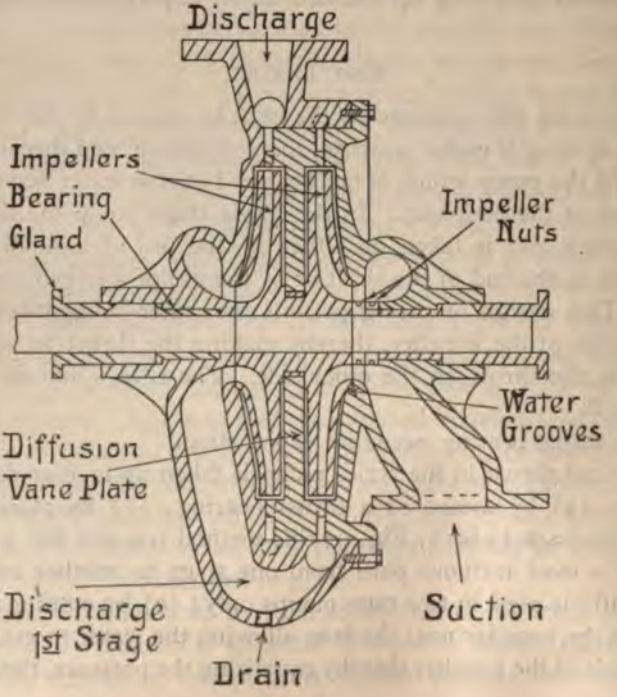

Discharge
Impellers
Bearing
Gland
Impeller Nuts
Water Grooves
Diffusion Vane Plate
Discharge 1st Stage
Suction
Drain

FIG. 9.

seen in Fig. 10 at A which shows the hole; (d) by placing a small balance disc on the last stage, this is much on the same order of the dummy piston used on steam turbines to take up the steam thrust, the area of the disc is so designed that the proper balancing presure will be exerted on the shaft. All series pumps are usually fitted with a small thrust block to prevent creeping of the shaft and to insure proper alignment between the fixed and the moving parts of the pump.

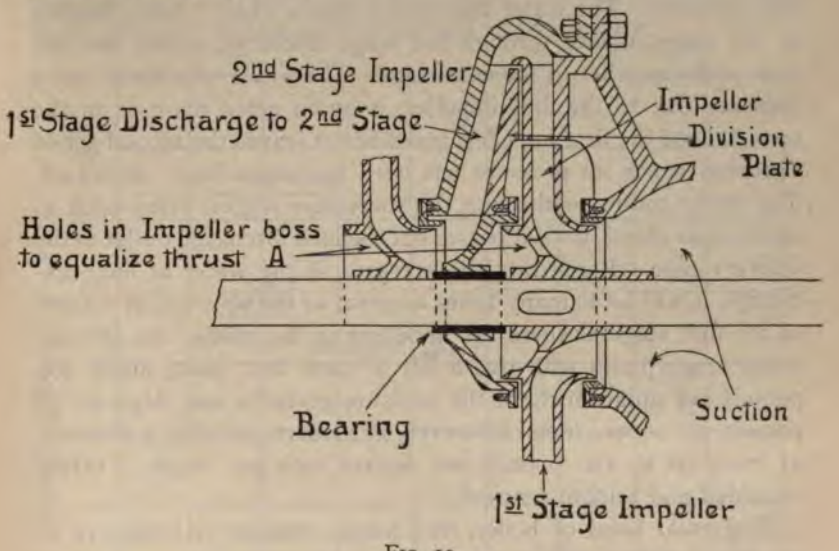


FIG. 10.

SHAFT PACKING AND LUBRICATION.

At each end of the shaft where it passes through the casing there is placed the ordinary type of stuffing box, the rubbing surface being lubricated by the water trickling through from the pump casing. The bearings of the pump are of the self oiling type or forced lubrication. The bearing of the division plates between the stages is of white metal, being a white metal collar around the shaft lubricated by water.

THE SERIES OR HIGH PRESSURE PUMP.

We now come to the high pressure or high lift pump, such as is used for fire pumps, boiler feed pumps, mine drainage pumps, and numerous other high lift duties. This pump consists of from two to 12 separate impellers, depending upon the lift, all inclosed

in one large casing but each impeller separated from the next by a division plate. The impellers and passages are so arranged that the water passes successively through them before it enters the discharge outlet. Briefly the action is as follows: water enters through the suction opening and enters the eyes or inlets of the first impeller where it comes in contact with the impeller blades. The blades impart velocity to the water, and the latter passing through the impeller outlets meets the diffusion vanes which vanes change the velocity into pressure. The water then passes into a small volute chamber of the stage, thence through the stage discharge outlet into the eyes of the impeller of the next stage. The water which now has a pressure due to the first impeller, is again acted upon as in the operation of the first impeller, and when it leaves the second set of diffusion vanes its pressure has been correspondingly increased. The water continues through the successive stages, acted upon in each one as above, until it passes out the final discharge outlet to the delivery pipe. Regarding the pressure of the water at final discharge, it will be as many times as great as the pressure at the end of the first stage as there are impellers in the pump. An efficient seven stage pump will give a lift of 2200 feet, being about 960 pounds per square inch, or the pressure given by one stage is 137 pounds per square inch. However, in modern practice, a pressure of from 90 to 110 pounds per square inch per stage is rarely exceeded and seldom reached.

The usual form of boiler feed pump consists of from five to six stages with a split casing, the pump shaft being connected to the motor shaft through a flexible coupling. The split casing allows the pump rotor to be taken out as a whole for cleaning or overhauling. This type is much simpler than the built up type in which the stages and their chambers are added on longitudinally, and the whole held together by through stay rods. The main joint against heavy pressure, in the split type, is a plain one, the two halves of the casing being held together by numerous heavy bolts equally spaced, and as the casing flanges are carefully machined the joint is a rigid one and easily kept tight. Fig. 10 shows the first two stages in part of a high pressure serits pump.

The curve in Fig. 11 shows the performance of one of these pumps driven at constant speed with varying quantity, the conditions under which a boiler feed pump on board ship would be working. The efficiency of this pump varies between 50 and 80

per cent, according to the design, a fair average would be 70 per cent; taking the efficiency of a motor driving the pump at a constant speed as 90 per cent, the combined efficiency will be 63 per cent, the 70 per cent being the manometer efficiency of the pump, *i. e.*, the ratio of the actual head delivered to the theoretical head. Under these conditions you will notice from the curve that while the quantity is varying from 60 per cent to 120 per cent of normal and the head about 15 per cent, the efficiency of the pump drops but 6 or 7 per cent below its normal value. The figure 63 per cent is the efficiency of the pump at normal rated capacity.

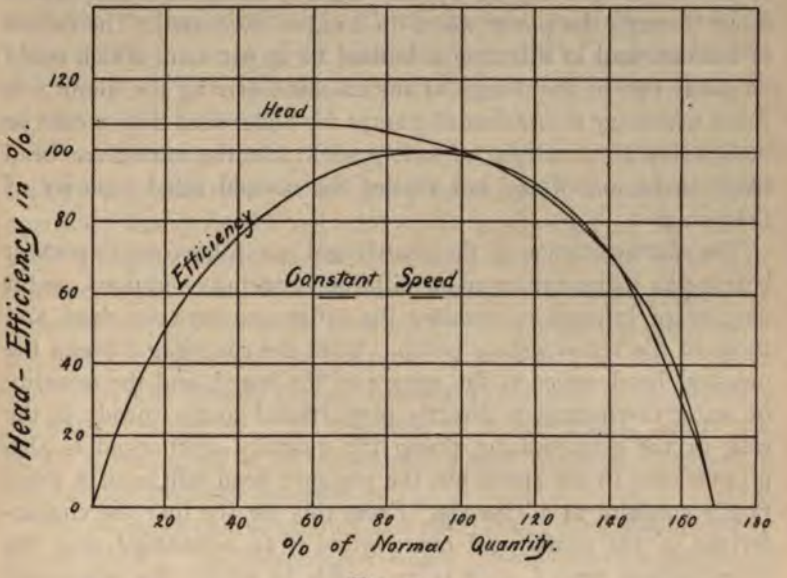


FIG. 11.

The efficiency curve coincides nearly with the head curve, the efficiency falling off as the head is decreased, but the head in a boiler feed is not likely to be changed much for the reason that the steam pressure in the boiler is practically a constant. There might be a slight increase in head due to the closing down of the check valves, but the efficiency in this case varies but little up to the rated capacity. If it should so happen, which is not likely to be the case, that all checks should be closed at the same time thereby increasing the head until the impeller churned water, the efficiency of the pump would reduce to zero, but the power required to drive

the pump would be only about 40 per cent of the power required at normal capacity.

As before stated the condition that would be met with aboard ship would be that of varying quantity. Consulting the curve again we see that the efficiency varies but little even down to 20 per cent of normal quantity delivered, and as the quantity delivered increases up to normal the efficiency increases.

There is a small increase in power required when the head against which the pump is working is decreased. This increase is due, to a great extent, to the drop in efficiency caused by the increased friction set up by the larger volume of water which flows through the pump when the head is decreased. The extent of the overload in this case is limited to 25 per cent, which could be easily met in the design of the machine driving the pump. It is not necessary to say that all pumps for boiler feed duty would be designed with a margin of safety such that the maximum head likely to be met would not exceed the normal rated capacity of the pump.

The characteristics of the centrifugal pump have an important bearing on its operation under different working conditions, and it may be of interest to consider the difference between them and those of the reciprocating pump. With the centrifugal pump the pressure head varies as the square of the speed, and the quantity of water discharged is directly proportional to the speed; in the case of the reciprocating pump the quantity discharged is also proportional to the speed but the pressure head will remain practically constant at all speeds. From this we see that the characteristic of the centrifugal pump gives it an advantage over the reciprocating type, *i. e.,* it is impossible to subject the pump and discharge pipe line to a higher pressure than that corresponding to the operating speed. For this reason it is possible to run the centrifugal pump at its normal rated speed with the discharge valve closed. It is a well known fact that when a centrifugal pump is running at constant speed and the head is gradually increased, a point is reached at which the pump ceases to deliver any water, because the head at this point will exactly balance the pressure delivered by the pump, and the impeller will simply churn the water in the casing. This would be the condition when the pump was running at normal speed with the discharge valve closed. This point can be made clearer by imagining a pump to

be discharging into a vertical standpipe of infinite length. As the pump is started and brought up to normal speed the water gradually rises in the pipe until it reaches the maximum head or height against which the pump is designed to deliver. The water now comes to a standstill and the impeller churns the water, but the energy generated by this churning will be sufficient to hold the water at the level at which it stopped. If the pipe could now be shortened below this level the flow of water through the pump would again start. So in the case of the closed discharge valve, if the valve is opened the head is lowered and the flow again set up. The surplus pressure generated in the pump always holds the water against the face of the closed valve at a pressure equal to the maximum head of the pump, if the pump be running at normal, or if not, at a pressure corresponding to the speed at which the impeller is turning.

It is a fact that while closing the discharge valve of a reciprocating pump will result in the pump being heavily overloaded, this operation has quite the opposite effect in the case of the centrifugal pump, in which case the load is increased by the opening of the discharge valve. This increase is due to the fact that when the pressure in the delivery is reduced by increasing the opening of the delivery valve the surplus pressure produced by the pump is converted into velocity thereby causing an increase in the quantity of water discharged. An overload on a centrifugal pump will result if the speed is increased above that required to generate the normal discharge pressure.

The requisite characteristics of a good boiler feed turbine pump are as follows: the horsepower required should reach a maximum at about the amount discharged corresponding to the maximum efficiency, which quantity would be that for which the pump is designed. After this point is passed the power taken becomes less as the flow increases, so that should the head on the pump be suddenly diminished, as through the breakage of the discharge line, or the sudden opening of a large number of checks at the same time, the horsepower consumed will actually decrease, thus rendering an overload in such a case impossible. This fact makes possible the use of smaller motors or turbines and permits the use of a motor or turbine which has the maximum efficiency at the output of the pump under normal working conditions.

As an example of an improperly designed pump: say at no delivery the pump generated a head of 200 pounds (delivery valve closed). When the valve is opened the head immediately rises until the pump is delivering 350 gallons per minute (normal), when the head is found to be 260 pounds. As the amount delivered increases the head falls. The greatest efficiency of the pump is obtained at 450 gallons per minute say; the head generated at this point would be about 235 pounds, which should therefore be the working head of the pump instead of 260 pounds which it generates at a normal discharge. The head at no delivery being 200 pounds the pump would not, when working against a static head as in a standpipe, begin to deliver until the speed has been considerably increased or a bypass opened. The power consumed by this pump would steadily increase from the point of no delivery up to the maximum quantity discharged. This means that if the discharge of the pump be suddenly opened, as when beginning to pump into an empty boiler, or when all the checks on the feed line are suddenly opened, the amount of power consumed would be excessive thereby causing a heavy overload; and the installation of a very large motor, in comparison with the power required, would be necessary.

A boiler feed pump should be capable of giving a steady, uninterrupted service with only very little attention. The simple reciprocating pump has fulfilled the above condition to a certain extent in spite of its very large steam consumption, its tendency to produce shock and vibration, its inadaptability for close regulation, and its numerous valves to care for.

The rotary feed pump is free from these defects and possesses several advantages besides: the supply of water can be regulated at the boiler independently of the pump; there is no danger of the breakage of the pump through loss of suction due to hot water; the pump contains no valves and has only two packings to be kept tight against water; there are no pistons, cylinder heads or packing rings to break on account of loss of suction and consequent racing and pounding.

Simplicity of construction and accessibility for inspection are essential for any pump that is to be installed for boiler feed purposes. The general type of the modern rotary pump casing is the split form as described in an early part of this paper. In this form the entire working parts of the pump are exposed on the

breaking of a single joint, and after removing the shaft bearing caps the entire impeller may be lifted out. Compare this with the case of the reciprocating pump with its numerous working parts and valves to be kept in order, both steam and water ends; also the number of joints to be broken in the case of the overhaul of the pump.

From an approximate computation, at maximum efficiency, of a well designed reciprocating pump and a turbine pump with induction motor, both pumps of the same capacity, the steam consumed per i.h.p. hour by the former was about 90 pounds, while in the case of the latter the consumption was only about 36 pounds, from half normal capacity up to full. This comparison shows a consumption of less than half the steam for the turbine pump. At lower loads than half the difference in favor of the turbine pump is not so marked yet it is still considerable.

SOME ADDITIONAL ADVANTAGES AND SUMMARY.

There are no sliding parts or wearing parts except the bearings of the shaft, thereby entailing practically no cost of upkeep.

There are no valves to keep tight as in the reciprocating pump.

Its freedom from breakdown due to its substantial and simple construction.

The water would be delivered to the boilers, or to the discharge pipe, in a steady stream without pulsation or shock, consequently there is no necessity for the air vessels now required for pumps of the reciprocating type. The above fact would be bound to relieve the whole system of piping with its joints of all such strains such as are now encountered with reciprocating motion pumps.

Should the boiler check valves be closed with the feed pumps running the pressure in the feed line would simply be raised to its designed maximum pressure, which is a small percentage above the boiler steam pressure. The feed lines would not have to be designed to withstand heavy pressures that might be brought on them, as is now the case with the reciprocating pump, but they could be designed for one set pressure and we would know that this pressure could never be exceeded for the reason that the pump would be incapable of delivering any pressure in excess under any conditions. With the reciprocating type of pump, it is well known that the strain on both pump and piping working under overload is likely to result in injury to one or both before the pump could be

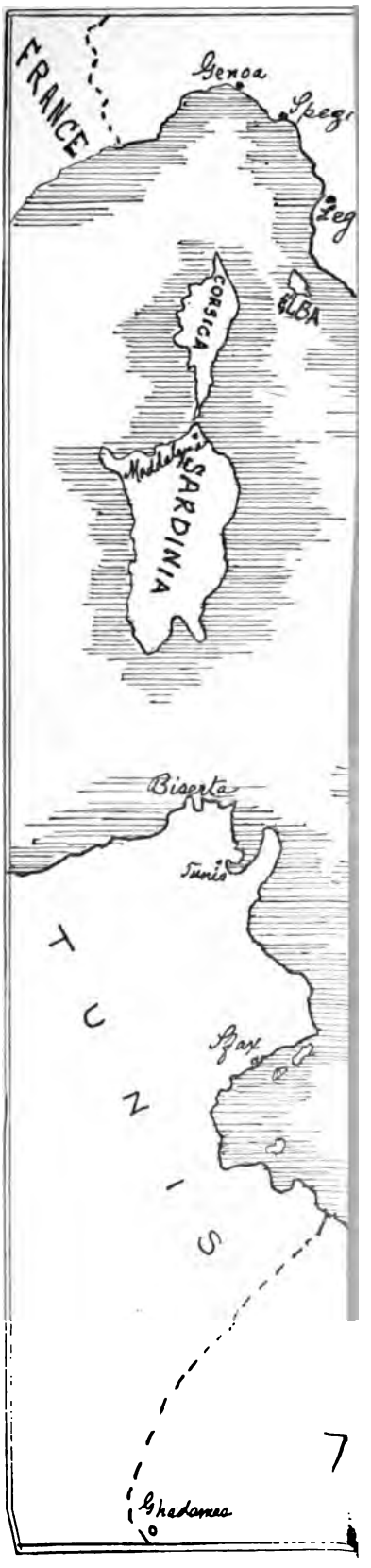
stopped, say for instance all the checks were suddenly closed with the pump running at full speed. Automatic devices to eliminate such an overload on the feed system have not proved altogether satisfactory.

There are no losses due to the starting and stopping of a piston, no loss of head due to water passing through the valve passages, no friction of stuffing boxes on a pump rod, no excessive leakage past a plunger or piston under heavy loads.

A large amount of worry and care removed from the senior engineer's shoulders on full power runs regarding the working of the feed pumps. On the beginning of the run all pumps would be started, and it would reduce to the simple question of the water tender manipulating his checks, no rings for more feed, no breaking down of the pumps due to excessive piston speeds required on all full power runs. The engine room force could hold no grievances against the deck force for shutting all the deck plugs without notifying the engine room that the services of the deck pump were no longer needed.

The price, weight, space occupied, reliability, are at present equal to the reciprocating pump, and further improvements now in progress will cause most of the above to be greatly in favor of the turbine or motor combination of the centrifugal pump.

When the simplicity of construction and the small cost of the centrifugal pump is taken into consideration, it seems rather remarkable that the use of it has been so limited. This is probably due to the impression which has held until recent years, that this pump was useless for other than low heads. Now that its satisfactory working at high heads has been demonstrated, there is every reason to suppose that it will soom come into use to perform the duties formerly allotted to the reciprocating type. The boiler feed turbine pump is being rapidly adopted by the large land power stations, and its operation has been found most satisfactory. Many water works are adopting it for feeding their pressure mains for the city supply as well as for supplying the pressure fire mains. Also the latest automobile fire engines have adopted the turbine pump using the gas engine as the motive power for driving it.


FRANCE
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SARDINIA
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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ITALIAN-TURKISH WAR.

(CONTINUED.)

By COMMODORE W. H. BEEHLER, U. S. Navy (Retired).

(Compiled and translated from the *Marine Rundschau*, and other sources.)

EVENTS IN THE RED SEA AND VICINITY OF SUEZ CANAL.

For the protection of the Italian colony of Erythrea, the *Aretusa, Volturna* and *Staffeta* were cruising in the Red sea and, on October 2, 1911, engaged the Turkish destroyer *Prik-i-Schewket* which fled into the harbor of Hodeida, the Italians then engaging the ships and forts and withdrawing after sinking a custom house motor boat. The Italian garrison in Erythrea was reinforced from the 3700 Italian regulars to 10,000 men by recruiting natives. The cruiser *Puglia* landed 5 and 6-inch guns that were mounted on the works at Massowah.

September 30 the Turkish armored coast defence ship *Muin-i-Zafer* that had been stationed at Beirut arrived at Port Said and the Turkish transport *Kaiseri* with 700 Turkish troops came from Hodeida. Several days later a Russian transport also arrived from Hodeida with 800 Turkish troops. As the Turkish vessels did not leave within 24 hours the Italian and British consuls protested and the Turkish troops were landed and taken to the hospital because of the prevalence of cholera. The troops were subsequently sent via Kaleat and El Arich under Egyptian escort to Palestine.

The *Muin-i-Zafer* and an old Turkish gunboat that had arrived at Port Said were disarmed, their guns and ammunition being landed at Port Said.

THE CRUISER WAR.

As soon as war was declared both belligerents proceeded to seize unarmed vessels of the enemy. The Italians began by seizing two steamers carrying small detachments of Turkish troops

off the Albanian coast, and the Turks seized an Italian steamer in the Dardanelles loaded with grain and lumber. Subsequently, large vessels were not seized, and prizes were limited to smaller craft, fishing boats, sailing yachts, motorboats, etc., details of which were not published. In the Bay of Smyrna sixty-five small Italian vessels were seized before October 13.

The Hague Convention and London Conference on International Law were proclaimed by both belligerents to be respected, though neither had ratified the Hague Convention which had been signed by their representatives. The Turks were not even represented at the London Conference.

The Italian government proclaimed that contraband of war included guns and weapons of all description, ammunition and all material that may be used in war or be directly serviceable for the land and naval forces. The Turkish government issued a similar proclamation. To avoid conflict with Russia the Turkish government agreed to permit neutral vessels to pass through the Dardanelles from Black Sea ports, provided they did not take contraband of war and even permitted neutral ships to pass bound for Italian ports in case their cargoes were not consigned to the Italian government or to be of service for the military or naval forces of Italy.

Prize courts were established by both belligerents during October.

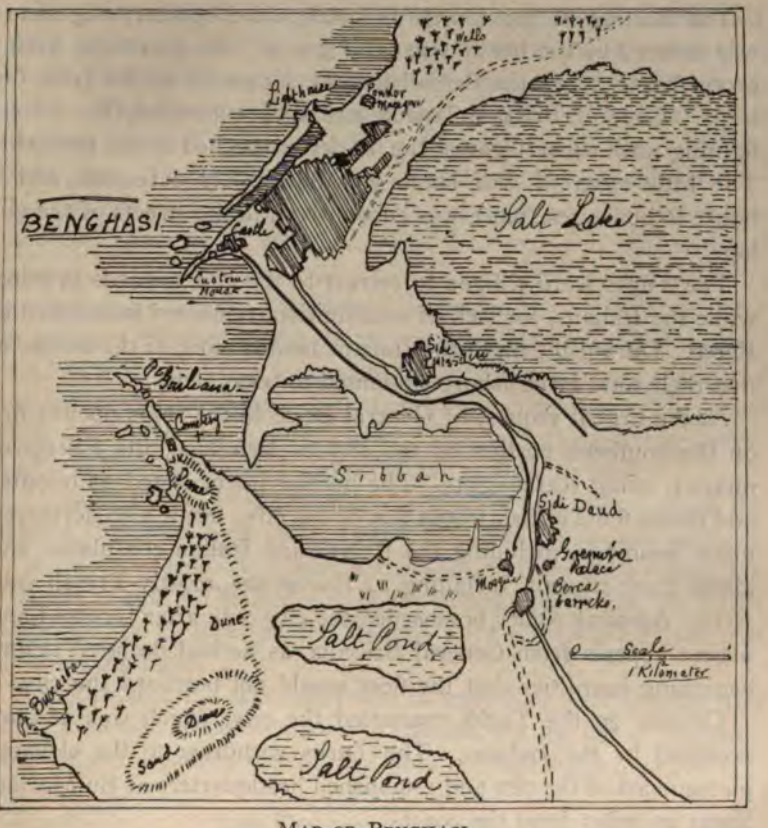
THE OCCUPATION OF BENGHASI.

The official report of Lieutenant-General Briccola gives the following details of the operations at Benghasi:

On October 18 a fleet of eight transports convoyed by the *Vittorrio Emanuele, Regina Elena, Roma, Napoli, Piemonte, Liguria* and *Etruria* with five destroyers and seven high-sea torpedo boats arrived off Benghasi with the staff and half of the Second Infantry Division. Admiral Aubry's demand for the surrender of the city was refused by Chakir Bey, who had a force of 400 regulars and 2500 irregular troops with two rapid fire batteries.

The Italians opened fire the next morning at a range of 1000 meters on the entrenchments at Berca to the southward, and on the lighthouse and magazine to the northward. At the same time, 8 a. m., the squadron landing force of 800 men and 4 guns disembarked, followed by the troops disembarking by means of the ships' boats, 13 pontoon floats and lighters from Tripoli.

The first sailor company landed at 8.50 on the Guiliana beach 2000 yards south of the city. One detachment went along the beach and occupied the Christian cemetery on a sand dune 10 meters high. Pioneers followed the first landing party and facilitated landing by five pontoon landing stages. Major-General Ameglio landed and took command. The Turkish troops stationed



MAP OF BENGHASI.

north of the city, to oppose landing there, rapidly reinforced those at Berca and vigorously attacked the center and right flank of the Italians. The ships bombarded the Turkish position, but the sailors in the cemetery were exposed to a heavy fire and also in danger of the shells from the fleet, so that they were obliged to temporarily abandon the cemetery. The torpedo boat *Orsa* with several armed ships' boats proceeded to the custom house wharf to see if

the Turkish troops had evacuated the city, but they were met with such a heavy fire from the troops concealed there that they withdrew. The fleet then directed a heavy fire on the custom house, which was completely demolished.

At 11.30 General Ameglio occupied the sand dunes back of Buscaiba Point with the sailors and two companies of infantry.

The landing of the fourth and sixty-third infantry regiments was delayed by the heavy seas until 3 p. m. At 3.30 these troops proceeded to attack the Berca barracks, supported by fire from the ships. General Briccola landed and took command, the troops fighting until sunset against the Turks intrenched at the barracks. The little town of Sidi Daub was obstinately defended, and a house to house resistance was encountered in the streets of the village.

The Turks were obliged to retreat to the city towards evening while the Italians, for lack of ammunition, remained intrenched at Berca. During the night the Italians landed more of the troops so that their total force ashore amounted to 6000 men.

At the urgent request of General Briccola the ships opened fire on the southern portion of the city of Benghasi, the European quarter, using searchlights. The bombardment lasted 20 minutes and drove the Turkish troops out of the city; but it also destroyed many buildings, including the British and Italian consulates, and killed many citizens, including 12 Europeans, mostly British subjects. Admiral Aubry bombarded the city only after repeated and urgent appeals from General Briccola, as he had declared before beginning hostilities that the fleet would not bombard the city.

October 29 the Turks evacuated the city, which was at once occupied by the Italians. The Turks withdrew to the elevated plateau east of the city and established headquarters at Bu Marian, about 20 miles from the coast.

The sailor landing parties re-embarked but left their guns ashore to reinforce the field artillery. The Italians reported a loss of 36 killed and 88 wounded, and estimated the Turkish loss at 200 killed and wounded.

A few days later the fourth infantry brigade at Benghasi was reinforced by the 68th regiment of the second brigade. The Arabs along the coast of Benghasi joined the Italians while the Arabs from the interior reinforced the Turkish troops.

Enver Bey, formerly military attaché at Berlin, commanded the Turkish forces. Frequent skirmishes followed but without decisive results. The Turks were usually repulsed by the shell fire from the ships.

THE OCCUPATION OF DERNA.

The *Pisa, Amalfi, San Marco, Napoli, Agordat* and *Coatit*, with three destroyers and several transports with troops, arrived off Derna, October 15, and negotiations for the surrender of the town failed. The *Pisa* then bombarded the town for 45 minutes. The fire was directed against the barracks and a small fort with two light guns. The fire was slow at rate of one shot per minute. As this was not answered a boat with flag of truce was sent in but was met with a volley of rifle fire. The four armored cruisers then opened fire on the town with 15 cm. and 19 cm guns and in the course of 30 minutes completely destroyed it. A landing party of 500 men escorted by the destroyers attempted to land at 2 p. m., but owing to the rough sea and heavy infantry fire from the Turks intrenched on the beach this attempt was repulsed. The ships then shelled the beach until 4 p. m. The next day a strong north-east wind and heavy seas prevented any attempt to land.

October 18 the Turks evacuated the place and 1500 men of the Alpine chasseurs with pioneers and field artillery took possession.

After this there were daily skirmishes and the Turks gave the Italians no rest. The Arabs from the interior reinforced the Turks daily, and on October 25 the Italians were reinforced by the 22d infantry regiment.

October 28 the Turks succeeded in capturing several guns and ammunition in an attack upon the Italians, but the fire of the ships drove them back and the Italians were not dislodged.

THE OCCUPATION OF HOMS.

October 16 the *Varese, Arpia* and four transports with the eighth Bersaglieri regiment having six field guns were sent from Tripoli to take possession of Homs. The Turkish commander refused to surrender and as heavy seas and bad weather prevented landing during the first three days the *Varese* and *Marco Polo* that arrived on the 17th, bombarded the castle and intrenchments on its flanks. The Italians estimate the Turks at 500 regular and 1000 irregular troops. The weather moderated on October 21

and the Italians landed after overcoming a stubborn resistance. Two Italian boats capsized. The Turks subsequently frequently attacked the Italians but were, as usual, repulsed by fire from the ships.

THE ITALIAN MILITARY POSITION AT TRIPOLI IN OCTOBER, 1911.

The first corps of the Italians were intrenched around the city of Tripoli from Fort Gagaresch 2 kilometers west of the city to Scharaschat 3 kilometers east. The right flank extended from Gagaresch to Bu Meliana and was held by the 63d regiment. The 82d and 80th regiments held the center from Bu Meliana to the village Henni, they occupied the cavalry barracks and Fort Mesri. The 11th Bersaglieri regiment occupied the left flank from Henni to Scharaschat. Serving as reserves, in rear, at the extreme flanks, the naval landing brigades from the training ships squadron and a part of the 4th infantry were stationed.

The desert afforded unobstructed view of the approaches on the right flank so that the Turks were there exposed to the gun fire from the ships. The center was opposite the edge of the oasis and the left flank faced the oasis where elevations, trees, garden walls and buildings obstructed the view of the country beyond.

It was difficult to reconnoitre this country and the Italians used aeroplanes, three aeroplanes at Benghasi and six at Tripoli. The first aeroplane was used on November 1, from which hand grenades were thrown upon the Turkish camp at Ain Zara.

The Italians used a hand grenade invented by Lieutenant Cipelli of the navy, who was killed by an explosion of one of these grenades. These Cipelli grenades are made at Spezia. They are formed of a steel shell, about the size of an orange, filled wtih picrate acid. A cap is inserted just before the grenade is to be used. It is exploded by a steel ball that is withheld in position by means of a safety pin that is removed immediately before the hand grenade is thrown. The steel ball is held in place after the removal of the saftey pin by pressure of the hand. In case the aviator is alone in his flight it is necessary for him to use one hand on the steering gear while he holds the grenade between his knees to remove the safety pin with the other hand. The use of the aeroplanes at Tripoli was much limited by the winds and dust from the sandy desert.

The Italians suffered for lack of water as the available wells were not sufficient to supply them with water. Naval water-boats were in constant service transporting water from Sicily to Tripoli.

Cholera prevailed and the Italian army suffered a loss of 25 to 30 men daily who died from cholera. The mortality among the civilians in Tripoli was much greater.

THE TURKISH POSITION AROUND TRIPOLI.

The Turkish garrison of 2870 men withdrew to Ain Zara about five miles south of Tripoli with their main body at Zanzur, 12 miles southwest of the city. Their outposts were close to the Italian lines. By strenuous work the Turkish commander, Colonel Neschat Bey, organized an effective force which he recruited from the natives by volunteers to 20,000 men by November 1, and which was being daily reinforced. These volunteers were good riflemen and marksmen but undisciplined. The chief bases for recruits were at Aziziah, Kasr Gharian, and Kasr Veffren, from 40 to 75 miles south of Tripoli.

ENGAGEMENTS AT TRIPOLI DURING NOVEMBER, 1911.

A series of attacks on the Italians were made in force by the Turks with 6000 men on October 23-26, chiefly against the Italian center and left flank. These attacks ware supported by a revolt of the people in the city that was suppressed with great loss by the 11th Bersaglieri regiment. The *Sicilia* and *Sardegna* participated in the defence of positions on the left flank by shelling the Turks. The Turks were finally repulsed but they gained position by capturing Bu Meliana, Henni and Fort Mesri with several field guns, machine guns and other war material, together with about 100 prisoners.

The Italians were obliged to take up a new position that extended from the right flank to Feschlum and Schara Zaniet. The Turks took possession of the forts around the city and, on October 31, they began to bombard the city from Fort Hamidje. They were soon silenced by the gun fire of the *Carlo Alberto* and *Lampo*.

In the battles of October 23 and 26 the Italians lost 382 killed and 158 wounded. The Italians estimated the Turks lost 1000.

The civilians who participated in the revolt were arrested and about 100 were convicted and shot. It was reported that a much

larger number of civilians were executed, some stating over 400, but this has not been verified and was denied by the Italian government. It was reported that some of the irregular Arab troops, who had expended their ammunition and surrendered, were shot. In consequence of these reports the Turkish government protested against the inhumanity of the Italians to the Hague court. The Italians claim that the native population were only treated as absolutely necessary for self defence. General Caneva then sent 3000 of the citizens as prisoners of war to Gaeta and the Islands of Ustica and Tremiti. He also compulsorily disarmed all the natives.

The Italians were reinforced by fresh troops from Italy to the number of 30,000 men by November 7, after which they began to retake the positions formerly occupied. The fifth brigade of infantry that had just arrived recaptured Fort Hamidje with difficulty. The training ship division shelled Fort A-Sultanje, and C-Fort Gargaresch. Two battalions made a reconnoissance in force towards Ain Zara and Zansur.

The Turks made a series of attacks after November 9, but were repulsed by shell fire from the ships *Liguria, Carlo Alberto, Partenope* and *Cigno*. The hotly contested entrenchments at Bu Meliana were recaptured but had to be abandoned again because the heavy rains had flooded the neighborhood. In the confusion of the flood the Turks made a vigorous attack on November 17 and captured several Italian guns. The rainy season deferred extensive invasion into the interior.

November 5, 1911, the King of Italy proclaimed the annexation of Tripoli and Cyrenaica as under the complete sovereignty of the Kingdom of Italy.

REINFORCEMENTS FOR THE ITALIAN TROOPS.

A second expedition corps was formed and transported in detachments to Tripoli and Cyrenaica during the early part of November. The organizations were as follows:

THIRD INFANTRY DIVISION, LIEUT.-GENERAL DE CHAURAND.

5th Brigade.	*6th Brigade.*
18th regiment infantry.	52d regiment infantry.
93d regiment infantry.	23d regiment infantry.

1 regiment field artillery, 6 batteries.
3 squadrons cavalry.

FOURTH INFANTRY DIVISION, LIEUT.-GENERAL COUNT TROMBI.

7th Brigade.	*8th Brigade.*
20th regiment infantry.	37th regiment infantry.
79th regiment infantry.	50th regiment infantry.

1 regiment field artillery, 6 batteries.
3 squadrons cavalry.

By November 20, 1911, Italy had sent the following:

16 regiments of infantry	48,000
3 regiments Bersaglieri	9,000
3 battalions Grenadiers	3,000
4 battalions Alpine Chasseurs	4,000
4 regiments combination field artillery	6,000
3 battalions pioneers	3,000
2 battalions engineers	1,000
12 squadrons cavalry	2,400
3 squadrons Carabineers	600
6 detachments gensdarmes service	1,000
Train	7,000
	85,000

Exclusive of a detachment of special troops.

The troops sent to Italy included some of the men on reserve lists and were not exclusively those belonging to the active army.

Additional reserves were called out to replace these men to number about 90,000 additional reserves.

As there was a lack of officers trained as aviators, ten civilian aviators volunteered with a corps of artificer mechanics and 60 engineer soldiers. One half of these were sent to Derna and Tobruk and the others to Tripoli.

THE ACTIVITY OF THE ITALIAN NAVY.

The co-operation of the navy, after the landing of the first expedition corps, was to accomplish the following objects:

1. Support of the land forces in engagements on shore was assigned to the *Sicilia, Carlo Alberto, Sardegna* and *Marco Polo* off Tripoli and Homs.

2. The blockade of the Tripolitan coast that was first conducted by the cruisers and torpedo vessels was assigned after November 10 to the four new Italian mail steamers that formerly plied between Naples and Palermo and which were each armed with six-inch guns.

3. The Turkish coasts of Albania, Syria and the Aegean sea were reconnoitered by a division of four destroyers in each region.

4. The passages between Crete and the mainland were guarded by several ships and destroyers of the Duke of Abruzzia's command. As the transports conveying troops were constantly going to and from Tripoli and Italy without convoy it was necessary to guard these passages strictly.

Early in November several cruisers and torpedo boats bombarded the small Tripolitan coast ports at Suara and Adjita near the Tunisian frontier in order to destroy the contraband stores that had been collected there from across the Tunisian border.

The ships of the first two squadrons left October 24 for Augusta, Tarento and Naples to replenish stores and fuel, and prepare for a new series of operations that were rumored to be contemplated against the Turkish forces in the Aegean sea.

Tobruk was established as a naval base and some of the fleet replenished stores and fuel there.

The Turkish squadron remained off Constantinople and rarely left the Dardanelles. In expectation of an attack by the Italian fleet, the Turkish troops on all the islands of the Aegean sea were reinforced, especially at Lemnos, Mythelene, Chios and Rhodes. The defences at the Dardanelles were strengthened and 5000 additional troops were sent there to reinforce the garrison. These rumors caused a large emigration of the inhabitants from the islands of the Aegean sea.

The defences of the Dardanelles that consisted of three forts at the western entrance with 20 heavy guns and 80 heavy guns in the forts at the narrow strait between Chanak and Nagara were strengthened with 120 additional guns but chiefly of smaller caliber. These forts were garrisoned by 7000 men and all the villages and buildings around these forts that might obstruct the fire of the guns were razed. The old mine fields forming three barriers at Kum Kale, Chanak and Nagara were reinforced by two additional mine fields with Whitehead mines of the latest construction at Kephes. The old mines were not reliable, they had been neglected and in that channel with depths ranging from 8 to 20 fathoms there is a strong current that often has a maximum strength of five miles per hour. Twelve old hulks were provided and made ready to be sunk in the narrowest part of the strait, that is at Chanak, where it is 1300 meters in width. The entire Turkish fleet was also pre-

pared to defend the passage through the Dardanelles. Admiral Fisher stated that in view of the topography and conditions in the straits of Dardanelles they could not be taken or forced unless the attacking fleet could afford to sacrifice twenty obsolete battleships and force the passage with the rest of the fleet, which should be of the most modern type.

At Gallipolis 25,000 Turks were stationed to defend any attempt to land there.

The heavily armed forts at Cape Karaburun and the Nasiki peninsula were strengthened and several batteries of rapid fire guns were mounted there to defend the approaches to Salonica, a city of 120,000 inhabitants. The entrance to the bay, two miles wide, was mined. The channels leading into Smyrna were defended by two forts at Sanjak Kalessi, 6 miles from Smyrna, which is a city of 300,000 inhabitants. These were strengthened and a new earthwork fort was constructed with twelve 15 cm. guns with several rapid fire batteries. 20,000 Turks were ready to prevent any landing.

At Mythelene the garrison was reinforced by 2000 troops. All the other important islands were likewise reinforced; Lemnos, Rhodes, Samos and Chios each receiving 1500 additional troops with artillery.

The Turkish government issued rifles to all Mohammedans in the islands of Aegean sea, and ordered all Italians that resided in the region around the Dardanelles to leave, and, in the course of November, transported many to other parts of the country.

Any attack by Italy on the Turks in Europe or Asia Minor would involve international complications as all powers have possessions there, and, besides, the great strength of the highly trained Turkish army would render such an attempt hopeless.

The Italian government, however, notified the Austrian and Russian governments of intention to blockade the straits of Dardanelles on November 20, 1911. The Russian government answered in a note, on November 24, that the neutrality of the Dardanelles must be respected; and based this claim on the Pontus treaty of 1871 which was further strengthened by the protocol of the Declaration of London of 1909, that stipulated that the approaches to neutral ports shall not be blockaded. The Declaration of London was not ratified by the powers. Russia also protested against the Turkish contemplated design of placing barriers in the straits of Dardanelles.

On November 27 Italy replied that she did not intend to blockade the Dardanelles, but, nevertheless, the Turks continued to strengthen its defences.

The Austrian and Russian ambassadors endeavored to mediate to secure peace, to which Turkey replied that she had no objection to concluding an honorable peace, but the loss of the two African provinces could not be permitted by the Young Turk government without endangering the country's constitution.

ITALIAN NAVAL OPERATIONS DURING DECEMBER, 1911.

The second squadron remained in South Italian ports while the vessels of the first squadron were distributed among the ports of Cyrenaica, and seldom visited the home ports. During the first part of December the *Roma*, *Regina-Elena*, *San Marco* and *Agordat* were at Benghasi; the *Napoli* at Derna; the *Vittorio-Emanuele*, *Pisa*, *Etna* and *Etruria* at Tobruk, with 12 torpedo vessels and the *Vulcano*; the *Marco Polo* at Homs, and the training ship squadron at Tripoli. These vessels co-operated in all the engagements with the army on shore, by landing parties, their naval guns and by bombarding the Turkish forces whenever within range of the guns of ships. The two old battleships *Italia* and *Sardegna* were prepared as station ships to relieve the training ship squadron. The Italians had a large supply of ammunition for the [illegible] guns of these ships.

The [illegible] the Duke of Abruzzi's flagship, remained at Taranto and Brindisi until the middle of December. Some destroyers and high sea torpedo boats of this division cruised [illegible] Western and Eastern coasts in the Ionian sea, the Aegean sea and along the coast of Asia Minor.

[illegible]

The Italian cruisers searched all the Arabian Red sea ports for Turkish vessels and troops. November 19 the *Puglia* and *Calabria* destroyed the port of Akaba, a place of 500 inhabitants, where Turkish troops had assembled. During the passage of the British king and queen through the Red sea en route returning from the coronation ceremonies in India, all hostilities were suspended until after November 26. November 30 the *Calabria* and *Volturno* bombarded the quarantine station Sheik Said near Perim and Mocca 40 miles north of Perim, where 5000 Turks with field artillery were preparing to cross the Red sea and attack Erythrea. They sank all their sailing craft, including a large number of dhows.

After clearing the Red sea of the Turks, the Italians re-established the lights on the coast of Erythrea.

ENGAGEMENTS AT TRIPOLI.

November 26, after the arrival of the third infantry division, commonly designated as the third army corps, the Italians attacked the Turks and Arabs and regained Forts Messri, Henni and Scharachat that had been occupied by the Turks after the battles on October 23.

After this repulse, in which the Italians lost 16 killed and 104 wounded, the Turkish main body withdrew from Ain Zara to the southward. The Turks, however, continued occasional assaults until December 4, when General Frugoni led a force of 16 battalions of Italian infantry with 5 batteries of field guns to attack the Turkish intrenchments at Ain Zara where 3000 Turks still remained. In the engagement that resulted in the capture of Ain Zara the Italians had 17 killed and 94 wounded, while they estimated the Turkish loss at several hundred killed. The Italians captured 8 guns that had been rendered unserviceable.

The Italians followed this up with a strong reconnoisance to the borders of the hill country, 30 to 35 kilometers south and southeast of Tripoli. Cavalry and aeroplanes served in this reconnoisance.

The oasis on the east side of Tripoli was bombarded in zones by the *Re Umberto, Sicilia, Partenope, Fulmine* and *Cassiopea* without finding any enemy therein, so that the 93d regiment of infantry was sent to garrison Tagiura about 15 kilometers east of Tripoli. The Italians next proceeded to intrench the newly acquired positions. A battery of 14.9 cm. guns and a 21 cm. rifled

Tripoli
Tagaire
MARGARETSCH
Siti Bla
ZANZUR
AIN ZARA
Cedeim
Gaba
Kasr
Langa
Bu Selim
Bir Chera
El Meamora
Bir Edim
Bir Tobras
Bir Ba Della
Bir Jerria
Sidi Sagah
Bir Bedua
Medakkem
Plateau di Gattia
AZIZIAH
Bir el Ashtat
Kasr Kuseba
Guassem
Rubda el Gharb
Kasr Lossaba
KASR GHARIAN
2 Castles
Biarfet
Tegrinna
Bibel
Kasr Turk

THE SURR

NTRY AT TRIPOLI.

howitzer that had been sent from Italy to bombard Ain Zara were now mounted there on the earthworks. A military railroad was constructed to connect Ain Zara with Tripoli.

The Italians thus found ample room for further operations into the interior and the fortifications of the approaches formed a secure base for conquest of the region.

ENGAGEMENTS AT BENGHASI AND DERNA IN DECEMBER.

The Arabs and Turks, estimated at 15,000, made frequent attacks by day and night on the strongly intrenched Italian garrison in the southern suburbs of Benghasi. The four regiments of infantry acted on the defensive and were supported by the *San Marco* and *Agordat*. The Italians rarely attempted a sortie. An attack of 20,000 Turks was repulsed on November 30 with considerable loss. Shortly after this the garrison was reinforced by the 57th infantry regiment from Italy. The battleship *Regina Elena* also arrived from Tobruk. During the night of December 14 and 15 the Turks attacked in great force but were repulsed by aid of the fire from the ships. The Italians lost several field guns.

At Derna the Turks and Arabs were estimated at 3500, but they were being constantly reinforced and a general assault on the Italian positions was expected. During the latter part of November the garrison at Derna made a sortie with three battalions of infantry and 150 sailors from the *Napoli*. In an engagement of 8 hours the Italians lost 15 killed and 37 wounded. Such engagements as these were frequent. November 30 Count Trombi arrived as Governor of Derna with large reinforcements, consisting of the 26th infantry regiment, one battalion of Alpine Chasseurs and one battalion of the 20th infantry, by which the strength of the garrison was increased to 15,000 men.

The Italian and Turkish forces in Tripoli and Cyrenaica were constantly reinforced. The arrival of the third army corps increased the Italian forces to 120,000 men, which were distributed as follows: At Tripoli, 70,000; at Benghasi, 25,000; at Derna, 15,000; at Homs, 5000, and at Tobruk, 5000.

The withdrawal of the Turks into the interior enabled them to reinforce their troops considerably. The cost of the war was defrayed chiefly by freewill offerings of all Islam. Turkish officers, and men, weapons, ammunition, and all kinds of supplies were constantly sent across the Egyptian and Tunisian frontiers, notwithstanding their neutrality.

The Italians occupied Sidi Barrami on the coast between Tobruk and Solum to prevent contraband and troops from entering across the Egyptian frontier, while the naval blockaders guarded the coast and captured several sailing ships with contraband.

The Italians complained of this violation of the neutrality not so much against that from Egypt, which was done secretly, but against that from Tunis, where it was carried on openly. The French government declared that it did all in its power to stop the transportation of contraband, and suggested that Italy should strengthen her forces along the frontier. The effect of French prohibition stopped the caravan trade via Delibat to Tripoli.

The Turks used Delibat, the eastern terminus of telegraph communication in Tunis, for despatches to Europe, and they built a telegraph line from their headquarters south of Tripoli to Quezzan, five kilometers from Delibat.

The Turkish sick and wounded were tended by French and German Red Cross societies and the Turkish Red Crescent society who reached the Turks and Arabs via Tunisian borders. The English Red Cross society sent their supplies to the Turks via Egyptian frontier.

The Italian government exercised a rigorous censorship over the press and correspondents of the newspapers were limited strictly in regard to their reports. These restrictions were so strictly enforced that the majority of prominent correspondents left Tripoli and returned to their homes, and, excepting a few French correspondents, the Italians only were represented and their reports were revised by the Italian authorities.

The Italian government, however, permitted all the military and naval attachés accredited to the foreign embassies and legations at Rome to visit Benghasi, Tripoli, Derna, Tobruk and Homs in the steamer *Bosnia* that was specially provided for them on condition that they would not publish anything they might see on the four weeks cruise that began October 18, 1911.

OPERATIONS OF THE ITALIAN NAVY UNTIL FEBRUARY 20, 1912

During January, the *Garibaldi, Varese, Etna* and some torpedo boats were at Tobruk, the *Ferrucio* at *Derna*, the *Etruria* at Benghasi, the *Marco Polo* at Homs and the *Carlo Alberto, Liguria, Iride* and several high sea torpedo boats at Tripoli. The greater part of the fleet that returned to Italy about the middle of December remained in Italy refitting, etc.

As the Italian patrol of the Turkish European coasts had been to a great extent withdrawn, and as it was evidently not intended to attack such ports, the Turkish government discharged the reserves in the garrisons of the islands and some of those on the mainland.

CHART OF RED SEA.

In the Red sea a threatened attack on the colony of Erythrea caused the Italians to reinforce the naval forces there so that they had there the *Piemonte, Calabria, Puglia, Aretusa, Volturno,* and *Staffeta,* with the four large destroyers *Artigliere, Granatiere, Bersagliere* and *Garabaldino.*

The Italian naval commander ascertained that seven small Turkish gunboats that had been in the Persian gulf were concealed near the Farsan Islands and the above named ships searched for them. These vessels had been ordered home, but ran out of coal and were unable to proceed: as the Turkish transport *Kaiseri* which had coal for these gunboats had been captured by the Italians. The Italians were ignorant that the lack of coal had prevented these gunboats from reaching Suez, and believed that they had entered the Red sea to transport Arabs to reinforce the Turks or to attack Erythrea.

January 7 the Italians discovered the seven gunboats with the steam yacht *Fuad,* at anchor at Kunfuda. The Italian ships opened fire on the gunboats and after three hours' firing at 4500 meters they sank all except three that were beached. The crews deserted the beached gunboats and the Italians completed their total destruction the next morning, getting some light guns and a few trophies from the little squadron. The Italians bombarded Kunfuda and captured four Arab sailing vessels and the yacht *Fuad,* which they towed to Massowah. They bombarded small Arabian Red sea ports; Akaba (for the third time on January 19), *Djebana, Sheik Said, Mocca* and *Midy.* The auxiliary cruiser *Citta di Palermo* bombarded a camp on the Sinai peninsula, but these bombardments caused very little damage to the Arabs, as *most of the shells failed to explode.*

The Italians thereupon declared the coast blockaded for a distance of 45 miles around Hodeida in the Red Sea, a seaport of 45,000 inhabitants.

This blockade became effective January 26, 1912. It was caused by the transportation of Turkish troops, money and supplies in neutral vessels to Hodeida. The Egyptian mail steamer *Menzaleh* was seized with 750,000 francs on board consigned to Turkish officials. The *Volturno* found 20 Turkish officers on board the British steamer *Africa* and the Austrian Lloyd steamer *Bregenz.* The blockade of Hodeida was assigned chiefly to the two large armed fast mail steamers *Duca degli Abruzzi* and *Duca di Genova* that had been sent from Italy with the cruisers *Liguria* and *Elba.*

In the bombardment of Djebana the *Piemonte* damaged the railroad building by the French there and the railroad company sued the Italian government for 200,000 lires for the damage to French property. The Italians took off about 100 British and some French residents of Hodeida.

Early in February the Italians supported the Arabian leader of the insurrection against the Turks, Said Idris, 200 of whose followers took possession of Farsan Island, while these insurgents put the Turkish forces of Yemen on the defensive and greatly relieved the Italians.

OPERATIONS AT TRIPOLI IN JANUARY.

The Italians were frequently attacked at Ain Zara by the Turks who established their active headquarters at Aziziah with their main body at Gharian. The Italians made repeated attempts during January and early in February to capture Zanzur but failed with heavy losses. The failure of an attack with four battalions of infantry, on December 17, caused the relief of Lieut.-General Pecori-Giraldi by Lieut.-General Camerana. The Turkish commander who defeated the Italians was Colonel Fara, who was promoted to Major-General for his victory. Details of this action were suppressed, but the Italians lost 50 killed and over 100 wounded.

The Turks surrounded Tripoli exterior to the circumference of a circle with a radius of 15 to 20 kilometers extending from near the village of Gargaresch around near Ain Zara to Bir-el-Turki east of Ain Zara. The natives of Gargaresch affiliated with the Italians and the Turks captured the town in order to punish the people for sympathizing with the Italians. On January 18 the Turks repulsed an attack by four battalions of infantry to recapture the place. The Italians were repulsed and only succeeded in taking the place after a desperate fight two days later. The Turks then withdrew but repeatedly renewed attacks on the Italians there. The Turks repeatedly attacked Ain Zara, but on February 5 they were driven out of their positions between Ain Zara and Gargaresch by long continued bombardment with 6-inch siege guns. An attack on Zanzur on February 22 with four battalions of infantry and three field batteries was repulsed by the Turks.

At Homs the Italians were obliged to remain close to the town. The Turks attacked repeatedly but were always repulsed by shells from the *Marco Polo*.

Zuara, 105 kilometers west of Tripoli, was a junction of the trade route between Tunis and Gharian. It was frequently bombarded by the Italian ships, but landing detachments were obliged to re-embark by the Turks.

The occupation of the town was decided upon just before Christmas when the *Pisa* convoyed four transports with the 10th infantry brigade to Zuara. Bad weather prevented landing, and after waiting several days the expedition returned to Augusta. The shells from the ships destroyed several buildings in the town but the energetic Turkish commander repulsed all attempts to land. The Italians finally abandoned the idea of landing as it would require greater sacrifices than the possession of the place warranted.

In Cyrenaica the Italians extended their occupation during January and February at Benghasi for a distance of 7 kilometers from the city and likewise at Derna and Tobruk. Strong fortifications were constructed, and heavy 6-inch siege guns were mounted on the works. At Benghasi the works were connected by a military field railroad ten kilometers long. At all these places the Italians acted on the defensive and repulsed the constant attacks by the Turks by aid of shell fire from ships, as these defenses were well within range of the guns of the ships in the harbors.

Invasion into the interior was not attempted and efforts were chiefly directed to strengthen the defences of a limited region along the coast and along the captured seaports. The Italians planned to prolong the war, and in the course of time by conciliatory conduct towards the Arabs to win them over and persuade them to accept the Italian conquest.

AVIATION.

The military aviators rendered good service as scouts. Lieutenant Rossi, of the Italian navy, made 60 flights at Tobruk and he recommended that the use of the Cipelli hand grenades should be discontinued because they are too difficult for a single aviator and very dangerous, besides which they rarely hit, and seldom exploded in the soft sand of the desert. Most all of the aeroplanes used by the Italians carry the aviator only. These aviators are obliged to ascend to heights of 1000 meters or more over the enemy's position that the aeroplane may not be hit by rifle bullets, notwithstanding the lack of proper aiming apparatus. In a flight at Tobruk, Rossi took Captain Montu as a passenger on February 1, and when at a height of 600 meters, the aeroplane was hit five times by rifle bullets and Captain Montu, himself, was hit and slightly wounded.

The Italian military aeroplanes carry the aviator only and are of the types of Bleriot, Nieuport, Etrich and Farman, with 50 horse-power motors. They cost about $6000 each, and will serve for about six months. It is contemplated to procure larger aeroplanes of 70 to 100 horse-power and capable of carrying several passengers. Upon arrival at the theater of the war they will experiment with various types of hand grenades. The Italian aviators instead of throwing hand grenades substituted Arab script calling upon the Arabs to surrender.

Captain Moizo made a flight to scout from Tripoli to Gharian, 85 kilometers south of Tripoli, and return, and on February 12 he made a flight from Tripoli to Homs and return, a distance of 240 kilometers, 150 miles.

CONTRABAND OF WAR TRANSPORTATION.

Solum, on the coast of the Egyptian-Tripolitan frontier, was the chief route for Turkish volunteers and contraband of war to enter Cyrenaica. The railroad terminus at Marsu Matruk, 300 kilometers west of Alexander, was connected by a good automobile road with Solum, a distance of 200 miles, and thus it was possible to cover the distance of 500 miles from Alexander in one day. Caravans then conveyed arms and ammunition in large quantities from Solum to the Turkish forces in Cyrenaica. Sailing ships loaded with contraband also landed near Solum where they could not be seized by Italian blockaders. The Egyptian telegraph operators also received telegrams for Constantinople via Alexandria and communication was practically uninterrupted.

These conditions were changed after December 15 by the Turkish cession of Solum to Egypt instead of to Cyrenaica, to which it had always belonged theretofore. Shortly after this cession Egyptian and British troops occupied Solum and suppressed the contraband trade. Lord Kitchener directed the strictest measures to guard against any violation of neutrality by conveying contraband and Turkish troops across the frontier beyond Solum. The telegraph operators were censored, and the British cruiser *Suffolk* arrived off Solum to enforce the observance of strict neutrality. These measures resulted in stopping 30 Turkish volunteers with two Russian aviators in their efforts to reinforce the Turks in Cyrenaica. But these measures did not prevent a large caravan of 175 camels to enter Cyrenaica from

Egypt, presumably via Fayum. This brought a large number of officers and men to aid the Turks.

The Italians protested at Paris against the contraband trade and open violations of neutrality across the Tunisian frontier. This protest was answered by a statement that Italy openly procured camels and provisions for her troops from Tunis and also purchased flying machines in France for her forces in Tripoli. The misunderstanding between Italy and France was such that the Italians finally ordered the seizure of two of the larger French steamers plying between Marseilles and Tunis, on which Turkish officers were suspected of being passengers. The French steamers *Carthage* and *Manouba* were seized off the coast of Sardinia, outside of Italian waters, and were taken to Cagliari where they were detained four days and released. On board the *Carthage* they found the French aviator Duval with an aeroplane that the Italians claimed was intended for Turkish military service. On board the *Manouba* there were 29 persons who claimed to belong to the second detachment of the Red Crescent society, while Italian officers claimed they were military combatants. The *Manouba* was obliged to land these 29 persons before proceeding on her voyage to Tunis.

The Italians were finally convinced that the aviator Duval did not intend to go into Turkish service and he sailed to Tunis. The 29 persons of the Red Crescent society were detained, and, after considerable correspondence and debates in the French Assembly, they were finally released by the Italians to the French government. Upon arrival at Marseilles these 29 persons were thoroughly examined and found to be all surgeons, nurses or sanitary attendants, and with one exception, they were allowed to proceed to Tunis and thence to the Turkish headquarters. The one officer who was not allowed to proceed had large sums of money in his possession and was not solely on duty with the Red Crescent society.

The French government earnestly endeavored to stop all contraband trade. January 17, the Russian steamer *Odessa* arrived at Sfax from Prevesa and the Tunisian officials found a large consignment of arms and ammunition concealed in the coal bunkers. This cargo of 360 tons of war material was seized by the French Tunisian officers.

January 25, the destroyer *Fulmine* seized the French mail steamer *Favignano* in Tunisian waters and made a thorough search with force without finding any contraband on board. This episode made considerable excitement among the Tunisians, and caused such an animosity against the Italians that a large number of Italian residents in Tunis left the country.

The French sent the armored ship *Henry IV* and four torpedo boats from Biserta to the southeastern border of Tunis to stop contraband trade, and enforce the obligations of neutrality.

ITALIAN NAVAL OPERATIONS DURING FEBRUARY UNTIL MARCH 15.

The Turkish armored coast defense ship *Awn-Illah* (Help of God) and destroyer *Angora* were lying at Beirut, and the Italians feared these ships would interfere with the transportation of Italian troops to the Red sea.

Rear Admiral Thaon di Revel arrived at Beirut with the *Ferruccio* and *Garibaldi* early in the morning of February 24. The *Garibaldi* steamed in close and fired a blank shot. The Turkish commander sent a boat with a flag of truce to the *Garibaldi*, called the *Angora* to slip her chain and anchor in his lee close to the mole, and made preparations to defend his ship.

The boat returned with a written demand upon the Vali of Beirut for the delivery of the two Turkish ships in the harbor before 9 a. m., when unless a reply was received he would proceed to attack the two ships and he would be governed by Article 2 of the IXth Convention of the Second Hague Conference.

The Italian cruisers proceeded to the eastward in St. George's Bay awaiting reply from the Vali.

The Vali received the written demand for the surrender of the two ships at 8.30 a. m., and was in the act of giving his consent; when, at 9 a. m., no answer having been received by the Italian admiral, the two ships opened fire on the *Awn-Illah* at 6000 meters, which replied slowly for about twenty minutes without making any hits. At 9.35 a fire broke out on board the *Awn-Illah* and ten minutes later the Turks hauled down the flag and abandoned the ship with the surviving members of the crew of 220 men. The *Garibaldi* stood close in and at 600 meters fired with the 76 mm. battery on the *Angora* without inflicting any damage. The *Garibaldi* then discharged a torpedo at the *Awn-Illah* but this deviated when half-way and ran in among a lot of lighters moored

a—Position of the torpedo destroyer *Angora*
a—Second position of *Angora* in fire-lee of *Awn-Illah*.
b—Position of *Awn-Illah*.
1—The Italian Cruisers *Ferruccio* and *Garibaldi* at 7 a. m.
2-2—Italians at 7.30 a. m. *Garibaldi* fired blank shot and *Awn-Illah* sent flag of truce to *Garibaldi*.
3-3—Position at 9 a. m. when Italian opened fire.
4-4—*Garibaldi* fired torpedo that missed.
5—*Garibaldi* fires second torpedo that sinks *Awn-Illah*.
5—Italians withdrew to the northward at 11 a. m.
7-7—Positions after returning at 2 p. m.
8-8—Italians sail to the westward.
T-T—Torpedoes launched by the *Garibaldi*.

within the mole and exploded causing six lighters to sink; ten minutes later the *Garibaldi* fired a second torpedo that struck the *Awn-Illah* amidships and caused her to sink until she grounded and laid aground with decks awash. The *Awn-Illah* lost three officers and 55 men killed with 8 officers and 100 men wounded.

Stray shots from the Italian cruisers did great damage in the city; 66 civilians being killed in the city and several hundred being wounded. A great many buildings were damaged, among them were the Banque Ottoman, the German Palestine Bank, the Salonica Bank, and the buildings and warehouses of the custom house, some of which caught fire and were completely destroyed.

The Italians withdrew at 11 a. m., out of sight to the northward. At 1.45 p. m., the two ships returned and the *Ferruccio* stood close in and fired upon the *Angora,* which was sunk by gun fire in the course of three minutes. The Italian ships then sailed to the westward.

In consequence of the Italian action at Beirut the Turkish government issued an order to expel all the Italians residing in the Wilyets of Beirut, Aleppo, and Damascus within 14 days after February 28, 1912; and that all Italians residing in districts that might in the future be attacked by Italian naval ships should be expelled from those regions. This affected 60,000 Italian residents in those regions.

The expulsion of the Italians from the Wilyets mentioned was strictly enforced. Those who did not leave voluntarily were compulsorily transported.

After February, Italian torpedo boats again patrolled Turkish Mediterranean coasts, and the Italian press stated that hostile operations would be conducted in the Aegean sea. It was stated that the Italians had only officially declared their intention to avoid attacks on the Albanian coast, and did not purpose to avoid all hostilities against other Turkish coasts.

In the meanwhile, as the Italian forces did not make any important progress in the conquest of Tripoli, and the friendly offices of the great powers to re-establish peace had failed, it seemed highly probable that the threats of hostilities in the Aegean sea, published by the Italian press, would be attempted. The Turks therefore decided to put all places liable to attack in the Aegean sea in thorough defence. Measures for this had been suspended during the previous month because they were given to understand

that the scene of war would be limited by the Italians to Africa.

The Turks began to strengthen the defences of the western approaches to the Dardanelles at Kum Kale and Sedil Bahr. The mine fields were reinforced and improved; 350 guns were added to the fortifications, chiefly taken from the forts of the Bosphorus. The troops were drilled daily at target practice and 40,000 infantry and cavalry were mobilized in the Dardanelles district.

The passage of merchant ships through the Dardanelles at night was prohibited, and because of the mine fields all were compelled to take pilots. Turkish torpedo boats constantly patrolled the approaches and the Turkish fleet was stationed at Nagara.

At Smyrna four large merchant ships were heavily laden with stones and held ready to be sunk in the narrowest part of the harbor channel at about six miles from the city.

Two torpedo boats that had been stationed at Smyrna were withdrawn to the Dardanelles.

An attack on Salonica was not expected so much because the commerce of that port was carried on chiefly by the Italian colony, and Austrians were largely interested. Nevertheless the Turks strengthened the fortifications and mine fields and reinforced the garrisons.

The Italian fleet in the meanwhile had completed all its refittings during the winter and assembled at Tarento and Tobruk. Vice-Admiral Aubry died March 4, and Vice-Admiral Faravelli succeeded as commander-in-chief. He in turn was relieved by Vice-Admiral Biale.

The ten Italian cruisers in the Red sea bombarded several Arabian ports; Midy, on February 29; Dubab (near Perim), on March 4. and Shiek Said on March 6. Midy was at the same time attacked and captured by the followers of the insurgent Said Idriss, to whom the Turkish-Arabian garrison of 60 men surrendered.

In consequence of the co-operation of the Said Idriss with the Italians, the ruler Iman Yahia proclaimed a "holy war," and called upon all the inhabitants of Yemen to lay aside their internal grievances and rally to the support of Turkey, to destroy Said Idriss, and energetically oppose armed resistance against the Italians.

After the blockade of Hodeida, the Turks established communications between European Turkey and Southern Yemen via Aden.

(CONTINUED IN NEXT ISSUE.)

DISCUSSION.

Navy Yard Problems.

COMMANDER E. L. BEACH, U. S. Navy.—This essay contains a valuable suggestion, that of regulating requests for alterations from ships in commission. The experience of sea-going officers must dictate to navy yards the necessity of certain asked for alterations and Mr. Otterson's method would bring the desirability of any particular alteration for one ship before the captains of all similar ships. This will be a step towards standardization. Mr. Otterson suggests that there be organized a "Fleet Board on Alterations" to be composed of the fleet engineer, ordnance officer, paymaster, medical officer, and naval constructor. It is suggested that an additional officer should be on this board, namely, the fleet repair officer. From the present naval bill it appears that the government will convert the collier *Prometheus* or *Vestal* to be a fleet repair ship. This ship will probably be fitted up to do work of far greater scope than the present small *Panther*. The last session of the House of Representatives passed legislation prohibiting repairs to be done by ship's crews while ships were at navy yards. Among ship's companies are expert machinists, boilermakers, coppersmiths, electricians, plumbers, etc. Experience as engineer officer ashore has brought me to believe that among the very best mechanics to be found at the navy yard are always men who have served enlistments aboard ship. Experience with the repair work has brought me to realize that enlisted mechanics on board ship can do just as good work as navy yard mechanics. The need of a navy yard results from the necessity of docking a ship and of doing work requiring tools of bigger capacity than can be installed aboard ship. The natural tendency of the legislation prohibiting ship's mechanics from doing ship work at a navy yard will result in keeping ships from navy yards as much as possible. A properly equipped repair ship, such as the *Prometheus* or *Vestal* is destined to be, would go far to lessening the frequency with which ships are sent to navy yards for alterations and repairs, and it is quite probable that with more ship work done by enlisted mechanics, whether of the ship's own force or from the fleet repair ship, some of the navy yard problems will disappear.

COMMANDER SUMNER E. W. KITTELLE, U. S. Navy.—The question of alterations to ships is already well considered by central authority, and with a decided resultant gain in economy. The Division of Material finally passes upon all alterations and makes its recommendations to the Secretary, after the alterations in question have been duly considered by the captains of all the ships concerned, by the division commander and the commander-in-chief, and after the various bureaus have contributed their advice. A broader or more comprehensive method could scarcely be devised, the sole drawback being the excessive time consumed enroute. A fleet board on alterations would doubtless tend to lighten the paperwork labors of

the flag officers, and to systematize consideration and thereby expedite decisions.

In considering the question of the number of our navy yards and the possible substitution of one very large yard for three of our present sites, my attention was called to a very clever solution by Captain Van Duzer, who has chosen a location on the flats of the New Jersey shore of New York harbor, above the narrows, and has there laid out a very complete plant, quite within the bounds of engineering accomplishment. New York is such a desirable location, considered from all standpoints, that this proposed plan commands consideration.

It takes a very broad type of mind, and a degree of unselfishness, apparently beyond our present average evolution, to consent to a general government policy that deprives our own little locality of a share of the government's annually expended moneys heretofore enjoyed. It is also a nicely balanced question, that of a national legislator's duty. How much of his allegiance belongs to his country and how much to his own district? Suppose on the one hand it is decidedly to the government's interest to abolish some unused navy yard, while on the other hand the local vote becomes angered at the mere suggestion of such loss? What shall the harassed statesman do in the premises? I think the solution will come when the office shall seek the man and not the man the office, from which one may calculate how long it will be before some navy yards are finally abandoned.

The questions of strategy involved in "Navy Yard Problems" have already been well considered and solved by accepted authorities, so that if we profit by the findings, we shall at least be building upon a foundation of sound strategy, without which disaster must sooner or later overtake us. Of course, if a powerful hostile fleet should find lodgment in our waters, while our own divisions are scattered at their respective bases we would be confronted by a very serious problem of concentration, but one that has by no means been overlooked by the Naval War College.

Sound strategy is cheap at any price, but after that is once secured we are free to pay closer attention to the government pocket-book, always remembering, what the devotees of the "pork barrel" are prone to forget, that even the most extravagant preparation is in the end millions less costly than the cheapest "marked down" war. If a concentration of navy yards is strategically sound then it should be had at all costs. If such consolidation weakens our position strategically, then all resultant economy is false.

While the only reason for the existence of navy yards is to dock, repair and victual the fleet, the question of labor must, nevertheless, be given a higher place in the problem than would at first seem apparent, not for the workman's own private sake, but in the government's interest, in the interest of economy and efficiency. So every reasonable endeavor should be made to secure and retain a good force of capable workmen, otherwise in emergencies green men have to be taken on, and the class of work turned out at once drops in both quality and output. For this reason Mr. Otterson's plan of assigning work to a navy yard, on the basis of

that yard's normal amount of emergency work, or in the final analysis upon the number of workmen employed, is worthy of consideration and trial. His plan will certainly tend to keep the number of workmen in all trades at a steadier average, and relieve the Navy Department of much importuning from the political friends of workmen discharged for lack of work.

If it is finally decided as a policy to maintain a certain number of yards, disposing of all others, then the work should be balanced among those retained in order that all may be in readiness for the unusual demands of war.

In assigning to each navy yard its quota of vessels for repair, the government has already covered this policy in a broad way.

COMMANDER J. B. PATTON, U. S. Navy.—1. The first part of this article proposes a form of procedure in handling requests for alterations. It differs from the present system only in requiring the division commander to prepare a new letter covering all ships of his division, when one ship asks for alteration; and in requiring the fleet commander to refer it to all divisions and then write another letter. This is suitable for any extensive alteration, and is now frequently done as shown by the reports of boards appointed to report on special matters.

2. The word "alteration" as now defined in the Regulations, includes any minor change in design or change in material used, notwithstanding the fact that nearly all "repairs" call for some change in design or material used, except for articles worn out by long use. These minor alterations can be settled satisfactorily by the ship's officers and navy yard, without reference to the division commander or Navy Department, and should be classed as "repairs."

3. The larger alterations should really be designated by the accounting department terms "changes and additions," and "repairs" by "wear and maintenance" or "casualty."

4. Many of the examples of alterations given seem too trivial to burden the flagship with, for example "foundation for evaporator pump," and therefore the author's scheme to make all alterations a division matter is not wise.

5: For the larger matters, it would doubtless be well to require the division commander to act on the matter, and recommend it for all ships, or one ship for trial, or for disapproval.

6. The fleet staff individually now pass on subjects coming before the commander-in-chief, and there would be nothing gained in having them act collectively on a subject in which, perhaps, only one would be interested. The present practice of appointing officers who are specially informed on the subject to be reported on, would appear the best. The idea could be better carried out by appointing a number of permanent boards to cover each class of alterations.

7. The question of the proper number and location of navy yards has been given careful thought by the Navy Department, and the proposal to abandon Portsmouth, Boston and New York, in favor of a navy yard

and naval base at Narragansett Bay is sound. There are some financial difficulties in the way, which have prevented the Department from definitely recommending this change. Therefore, there is a grain of comfort in having some one come forward and contend that we are all right as we are. But the great advantage that a base like Norfolk or Narragansett Bay has over New York is too apparent to be ignored.

8. A fleet anchored in New York harbor is only a "mob of ships." There is no room in North River for them, and at Staten Island they have to take their coal and stores when they can get them, and fleet routine is broken up. While at Hampton Roads the fleet is in full routine, and the ships pass in and out the bay, day or night, without pilots, and carry out their program of maneuvers; and at the same time they call for and get their coal and stores when they want them without interfering with their fleet work.

9. I believe in competition between navy yards to promote efficiency, but I agree with the writer that cheapness should not be the controlling factor in the distribution of work. A navy yard may make low estimates on work and receive the order, when they are so crowded with other important work that the new order may seriously interfere with it.

COMMANDER STANFORD E. MOSES, U. S. Navy.—Assistant Naval Constructor Otterson's article on Navy Yard Problems begins with a discussion of alteration to ships, and then shifts to the question of the desirable number of navy yards, and the purpose for which they exist. He makes a plea for the retention of our principal east coast yards, but does not mention those on the Pacific coast; or our over-sea naval stations. The paper discusses in general terms the distribution of work among the various yards; and lays particular emphasis, perhaps treats too seriously, the question of competition in manufacture.

The author deals with a few questions which seem to lie beyond the limits of navy yard problems.

It is suggested that a more logical treatment, or order of subjects, would have been to start out with the statement of the single purpose for which navy yards exist—the maintenance of the fleet—and then to consider the logical number, and the location of the yards we need. These points reviewed, there would then follow in natural order some consideration of the total expenditures, or of the total volume and character of work for the navy which is to be distributed among these yards.

With the work distributed upon any basis, perhaps upon one of those proposed by the author the next step would be some analysis of the character of this work.

All agree as to the purpose for which navy yards exist. They exist for the fleet.

As to the number and location of navy yards: probably a large majority of those who have studied the problem think that, for the present at least, we should retain the yards at Boston, New York, Philadelphia, Norfolk, Bremerton, and Mare Island; and naval stations at Guantanamo, Pearl Harbor, and in the Philippines. Hampton Roads and Narragansett Bay

should be developed as naval bases. This list represents a maximum number of naval establishments. Money should be guardedly invested in any naval station the retention of which is doubtful. The author need not have burdened himself with the problem of building up a single yard of abnormal proportions; there are other more pressing, and easier, problems; and it would be well to solve those first.

Consolidation and concentration of navy yards, when it comes (if it comes), will be a step-by-step achievement. The experience of England tells us this.

The distribution of work to our navy yards is now receiving systematic handling in the scheduled assignment of the various units of the fleet to established home yards; and in the regular rotation of ships at their respective yards. This is a great step in advance; and makes provision for perhaps three-fourths of all expenditures for labor. This program assures to the various yards a volume of steady employment which outweighs the smaller questions of competition in manufacture. With the work distributed to the various yards, the discussion comes to the character of work, and some analysis of it.

The general character of work at different yards will always be influenced more or less by local conditions, but the bulk of all navy yard work falls under one of the following three headings; alterations, repairs, and new work, including articles manufactured for issue.

Alterations are considered in the essay at some length, and somewhat academically. It is when the author suggests a new routine for the fleet that he seems to wander a little from the problems on shore. The Navy Regulations admirably cover the question of recommending alterations; and this routine is based upon the practice and experience of years. If officers concerned possessed a thorough knowledge of the regulations governing alterations and repairs, our navy yard problems would be simplified.

As to the suggested "Fleet Board on Alterations," the idea has some theoretically good points; but the organization of the fleet allows a board to be appointed as circumstances require, and the routine duties of the fleet staff include the functions of such a board. "Boards are long, and narrow, and wooden."

As a navy yard problem, proposed alterations should be viewed with suspicion, but each must be carefully considered lest a good idea escape. An alteration is in the nature of an invention, or improvement. "An invention is 1 per cent inspiration and 99 per cent perspiration," and the patent office proves conclusively that most improvements do not improve.

This question of deciding upon alterations is the most important problem touched upon in the essay. (The most important problem of all is never mentioned.) And it is this question of alterations to ships which demands, in the interest of both military efficiency and industrial economy, a close co-ordination between the officers afloat and ashore.

The author's tabulated presentation of fifty "fairly representative and typical" alterations might revive an old favorite theme of discussion, the object of which was to prove that those who go to sea in ships wish to be comfortable. Percentages are misleading when based upon *the number of items,* regardless of their relative importance; especially when

the proportion of military items is commented upon as not being as high as might be expected. The military and economical alterations given in the table probably involve more that nine-tenths of the expenditures of money, and nearly all problems come sooner or later to the question of cost.

The plan of altering ships by classes, while theoretically good, is open to some objections. Our ships, especially the larger ships, are now standardized in details of design. Sister ships are rarely twins. In the first five battleships of one class, there were four different arrangements of dynamo rooms, while, in the case of the latest type of ammunition hoist, a hoist fitted on one ship of a class could not be installed on a second ship of the same class; was disapproved by a third, and approved, with modifications, for a fourth ship of the class. Experience with one installation almost invariably suggests improvements, and this is another reason why it is not always advisable to make alterations by classes.

Next after the question of alterations comes the subject of repairs, an important navy yard problem, but scarcely touched upon by this essay.

The third class of navy yard work includes manufacture, and it is here that competition has been sometimes instituted. Objections to competition between the navy yards would be valid objections if this competition were carried to extremes, but it is largely confined to certain items of "repair" work, or manufactured articles, the total value of which is probably less than 10 per cent of the navy yard expenditures for labor.

Let us not stifle competition. There is no need to overdo it; but a certain amount seems necessary under conditions of government employment in order to secure the best attainable results. Gunnery has reached its most violent development, some may consider it a too violent development, but its spirit of competition has carried us far and will carry us farther. Year after year the records of past excellence become the points of departure for further progress. Our navy yards, let us hope, are entering a field of development analogous to the successive steps in the progress of gunnery and engineering afloat. It is well to remember that the jealousies and disputes which are the chief evils of over-stimulated competition, are also characteristic evils of idleness and stagnation.

No candid observer of our navy yard conditions to-day, comparing them with the past, can doubt that we have begun in our industrial work on shore a revolution as complete as that which has marked the regeneration of the fleet.

The principal objections raised to the spirit of competition in the fleet are largely traceable to the unusual youth of the majority of the personnel: a condition which is correcting itself. The navy yard work has been directed by a maturer element. The various bureaus and the commandant have directed and controlled all competition (the little competition which really exists), and the pleas for restraint, as made by one essayist and quoted by another, have, in the main, been foreseen and answered. Competition has been restrained and controlled; it has served a means instead of an end; it has sacrificed nothing important; it has kept down artificiality; there has been no attempt made to grade all competitors with exactitude.

Comparison of results may not suggest a way to increased efficiency, but it stimulates the loser, first to assure himself that he has fairly lost, and then to think for himself how he may fairly win. There is nothing so helpful as to make a man think. Pessimists may say that the loser may figure on winning unfairly, so long as he wins, but we must grant to these imaginary people the same standards of honor.

The most important of all navy yard problems is that of organization. For several years we have been trying various systems of management, and now, at last, as the result of trial and experience, there is crystallizing a definite and uniform method of procedure. The author has not touched upon this problem, and therefore a discussion of it is hardly pertinent. The subject is mentioned in the hope that some one may bring it under discussion in the broad spirit in which Assistant Naval Constructor Otterson has in his essay discussed the navy yard problems as he sees them.

An Improvement in Floating Dry Docks.

(SEE NO. 142.)

CIVIL ENGINEER LEONARD M. COX, U. S. Navy.—The plan proposed by Civil Engineer Cunningham is a most novel and interesting one, and appears to be the nearest approach that has yet been made toward the solution of the problem of an expansible dock. Civil Engineer Cunningham's first invention, developed a number of years ago, provided a dock which is capable of being used as a whole, or by sections as separate dock, and made it possible to increase the length whenever the demand made it desirable. In his new invention he has provided not only for future increase in length, but for increasing the lifting power as well, by the simple device of pontoons of varying dimensions.

The idea of varying depths of pontoons, and thereby making lifting capacity expansible, is one which must appeal very strongly to those who have encountered just such a problem during the last decade, when the increasing size of ships threatened to make dry docks obsolete almost as soon as they were completed. The Algiers floating dock was completed in 1902, and the "Dewey" dock in 1906. Each was considered the largest structure of its type at the time, and yet, in 1909, the writer was called upon for a report on the ways and means of increasing the capacity of both docks, so as to provide for lifting 30,000-ton vessels. In each case the beam of the dock was sufficient, but careful investigation diclosed the fact that, in the case of the Algiers dock, it was impossible to provide this extra lifting capacity without virtually rebuilding the structure. In the case of the "Dewey" dock, some five or six plans appeared practicable, but the cheapest and best involved an estimated expenditure of $300,000.00, and so increased the depth of pontoons, and, consequently, the working depth of water at the mooring, as to render the proposition inadvisable. Had either of these docks been built on the plan now proposed by Civil Engineer Cunningham, it would only have been necessary to detach a certain number of the center pontoons and place in their stead pontoons

slightly deeper and with considerable increase in length. The pontoons removed could easily have been converted into tending floats, or even small dry docks, for torpedo craft.

As regards the future lengthening of a dock of this type, the fact must not be lost sight of that such lengthening should be accomplished by the addition of two (rather than one) new sections, since it is inadvisable to bring a through joint at the center of the dock. For commercial purposes this caution is not necessary. since it is the current commercial practice to place slight reliance in the longitudinal stiffness of the dock. For naval purposes, however, the loosely connected sectional dock would not be tolerated, and the theory of design assumes that the side wall girders carry the bending moment due to the ship load and flotation. A central joint could be made of such strength as to provide for the maximum bending moment usually coming at the centre of the dock, but these joint sections would of necessity be so cumbersome as to make it cheaper to rivet them solidly, thereby sacrificing the ease of self-docking claimed by the inventor. In any event docks designed on this plan should anticipate future expansion by the use of low unit stresses, or increased load assumption.

One of the most valuable features of this design lies perhaps in the possibilities offered for rapid emergency construction. Should the need for such a dock arise suddenly, instead of waiting from one and one-half to two and one-half years for the delivery of the structure, contracts could be awarded to different firms for the side walls and various pontoons, and the whole assembled upon delivery. In time of war it would be possible to construct a 30,000-ton dock on this plan in four months time. Another advantage which seems well worthy of consideration is the ease and comparative safety with which such a dock could be towed long distances at sea. Instead of the risk attending the transportation of the dock as a whole—and only those who are familiar with the towing of the "Dewey" to Manila can realize the immensity of such an undertaking—it would be a comparatively safe and simple undertaking to tow each pontoon separately, and to so construct side walls as to enable them to be floated horizontally and towed as ordinary lighters.

CIVIL ENGINEER F. H. COOKE, U. S. NAVY.—The ideal type of floating dry dock, for naval purposes at least, appears to be the closest approximation to the "solid" or "box" type, compatible with safety and convenience of self-docking. Other important considerations are the ability to enlarge the dock with minimum expenditure of time and money, and rapidity of first construction; this latter point appears to be of prime importance, and under certain conditions might well be the determining feature of the design.

The type of dock proposed by the author appears to satisfy the requirements of facility of self-docking, ease of expansion, and rapidity of construction, to a marked degree, especially the two latter, in which the proposed type seems to possess very considerable advantage over the "Dewey" type. It seems to the writer, however, that there is too great a sacrifice

of longitudinal rigidity in breaking the continuity of the side walls. The ability to separate a dock into two or more smaller docks, self contained though each may be, does not appeal to the writer as of material advantage, per se, especially when moorings must be shifted, new moorings provided, connections made and unmade, etc., and when this ability is had at the expense of side wall continuity, it appears to be rather dearly bought.

As to expansion lengthwise, it appears to the writer that the continuous side walls of the original dock could readily be designed to admit the addition of a pontoon or pontoons at either or both ends; such metal as might be required to give the lengthened dock the requisite rigidity would, as surplus in the original length, be doing good service in decreasing deflections.

As to expansion vertically, it would appear that increase in lifting power without increase in length could well be had by constructing a low steel bulkhead across each end of the dock, to say, within one foot of the top of the blocks. For a dock 600 feet long by 150 feet overall width, an increased depth of 3 feet would increase the displacement by about 7500 gross tons, and this without change in pontoons or increase in depth of dock berth. The joints between pontoons, and between pontoons and side walls, should be made sufficiently water tight against the small head they would be required to resist, without difficulty or complication. Suitable drainage connections could easily take care of any leakage, the deck being given a camber for the purpose.

As to rapidity of construction, it appears to the writer that this need be not at all reduced were the side walls made continuous.

Although the dock would naturally be built on square lines, and of practically uniform detail, it is possible that perfect matching of holes would be found wanting, when it was sought to replace a pontoon by a spare. As a pontoon self-docked would materially reduce the length of the dock available for the simultaneous docking of ships, the provision of a spare pontoon does not seem to the writer to be justified solely for this purpose, but a spare might be exceedingly useful in case of injury to a pontoon.

The economy of first cost effected by reducing the depth of the end pontoons appears to the writer as of doubtful advantage, considering the permanent decrease in end displacement occasioned thereby, which might be of great disadvantage under certain conditions, as of a ship badly down by the bow or stern.

In the author's proposed type, as well as in the dock with continuous side walls, it would appear not difficult to make suitable connections between pontoons and walls, connections which would virtually make the transverse girders or trusses of the pontoons, and the vertical frames of the side walls, continuous U-shaped structures, yet which could easily be made and unmade by even working within the side walls. The pumps, which it would appear should be set close to the bottoms of their respective pontoons, could be readily coupled to and uncoupled from their vertical shafts, without disturbing the shaft stuffing boxes. Considerable additional longitudinal rigidity could be had by connecting together the ends of the

longitudinal girders which would naturally be built in the pontoons; these connections could be made of great strength, yet with their lower portions above water at light draft and accessible for inspection and repair from above. It would appear that the additional first cost of such connections, and the additional labor to make and unmake them, would be amply repaid by the gain in rigidity, and that such connections, together with continuous side walls, should go far toward approximating the "solid" type, while providing a design admitting of rapid construction, easy enlargement, and convenient self-docking.

The True Story of the America.

(SEE No. 142.)

In the communication of Mr. William Barry Meany, M. D., which appeared in the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, No. 142, June, 1912, under caption "The True Story of the America," second paragraph, line two, page 748, which reads, —"and wherein no mention of, or any reference to, the name of Commodore John Barry appears—reads:" It should have read —"and wherein no mention of nor does any reference to the name of Commodore John Barry appear—reads:"

PROFESSIONAL NOTES.

Prepared by LIEUT.-COMMANDER RALPH EARLE, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINE REPUBLIC.

VESSELS BUILDING.

Name	Displacement	Speed.	Armament	Builders	Remarks
Battleships					
Rivadavia.....	28,000	22.5	12 12-in., 12 6-in.	Fore River Co.	Launched Aug. 26, 1911.
Moreno.....	28,000	22.5	same	New York Co.	" Sept. 28, 1911.

The construction of the new port at Valparaiso will provide a harbor capable of berthing the largest modern ships and will include: A breakwater, 945 feet long; a quay wall 2066 feet long; strengthening and extending the Fiscal wharf to a length of 1214 feet; a quay wall 690 feet long; a jetty 820 feet long and 328 feet wide; a coal wharf 656 feet long and 100 feet wide, including coal transporters, hoists, cranes and railway, etc. All the necessary customs and other warehouses, administration buildings, lighthouses and coastguard stations are also to be provided. The new harbor, when completed, will have a depth of 40 feet of water.—*Shipping*, Illustrated.

AUSTRIA.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Radetsky.....	14,500	20	4 12-in., 8 9.4-in., 20 3.9-in.	Trieste	Commissioned
Zrinyi.....	14,500	20	same	"	"
Erzherzog Fr'z Ferdinand	14,500	20	same	"	"
Viribus Unitis.	20,010	20	12 12-in., 12 5.9-in.	"	Launched June 24, 1911
Tegetthof	20,010	20	same	"	Launched Mar. 21, 1912
VI.....	20,010	20	same	"	Laid down Aug., 1911
VII.....	20,010	20	same	Fiume	Laid down 1912

"VIRIBUS UNITIS."—Sketches show this to be a vessel with two stacks, two masts, and four center-line turrets each containing three 12.2-inch guns. The length is 488.7 feet, the beam is 88.5 feet, the displacement is 20,500 tons, and speed will be greater than 22 knots. Battery is twelve 12.2-inch 50-caliber guns, twelve 6-inch and eighteen 2.8-inch guns. Armor belt about 11.5 inches in thickness, protective deck 2.4 inches, turrets 12 inches.

There are four under-water tubes, one in bow, one in stern, one on each side. The torpedoes are 20.7 feet long, weighing 2794 pounds, and give at 3280 yards a speed of 40 knots.

Battleships *VI* and *VII* which follow are to be similar, but are to have six tubes.

NEW TYPE OF GUN AND ARMOR PLATE.—A new gun of 13.7-inch caliber has been constructed at the Skoda works of Pilsen, and proved. This gun is the type designed for the arming of the battleships succeeding the *Viribus Unitis* which carry twelve 12-inch. This new gun is exactly like the guns built by Vickers and Armstrong for the English service. The shell will weigh 1518 pounds, and will give a muzzle energy of 22,000 tons. The new battleships will be armored with some new plates called "electric armor," made by the Wittkrowitz works which manufacture the most of the armor plates for the Austrian Navy. The principal superiority of these plates will be in an annealing obtained by their passage through an electric furnace at a certain fixed temperature. This operation will give a metal with a very close grain, perfectly regular and homogeneous, with a resisting power much superior to the cemented steel of the Krupp process, and also at less cost.—*Le Yacht.*

DEFECTS IN NEW BATTLESHIPS.—A serious error has been made in the calculations of the weights of the battleships of the *Viribus Unitis* class, which prove to be overloaded by 1000 tons, their armor belt is submerged, and their maneuvering qualities greatly reduced. This error proved to be due, at least in part, to the fact that in the calculation the weights of the gun carriages were neglected. A lighter type of mounting was tried, then lighter armor plates, but neither sufficed, and the four *Viribus Unitis* are of too deep a draft.—*Le Yacht.*

ACTIVE SQUADRON.—A division of cruisers always in shape to go to sea was added to the active battleship squadron. This division comprises the battle cruisers *Sankt Georg* and *Maria Theresa*, the scouts *Admiral Spaun* and *Aspern.*—*Le Yacht.*

BRAZIL.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
M. Geraes,....	19,250	21	12 12-in., 22 4.7-in.	Elswick	Commissioned
Rio de Janiero,	28,000	22	14 12-in.. 20 6-in.	Elswick	Laid down Feb. 1910

The battleship *Rio de Janeiro* has been greatly delayed by modifications in the design. She is 632 feet long and 89 feet beam. The side armor is 9 inches, as is also the turret armor. There are three armored decks (2 inches, 1½ inches, and 1 inch). Will be driven by Parsons' turbines, and have Babcock & Wilcox boilers.

A cruiser *Ceara* is on the ways, also three submersibles of the Laurenti type have been built at the F. I. A. T. San Giorgio yard, Spezzia.

A bill to authorize the construction of a new harbor in Brazil for naval purposes, at a cost of $20,000,000, is reported to be at present before the government, and the Bay of Ilha Grande has been suggested as the most suitable spot. The proposal includes erection of docks and buildings, but the provision of defence and similar work would involve an additional expenditure of $10,000,000.—*Shipping*, Illustrated.

CHILI.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Constitucion ..	27,500	23	10 14-in., 12 6-in.	Elswick	Laid down Nov. 1911.
Libertad.....	27,500	23	same	Vickers	" " Dec. 1911.

The names of these battleships seem to be uncertain as yet. By some authorities they are the *Santiago* and *Valparaiso*.

According to a cablegram from Santiago de Chile, the Chilian Government has decided to have another battleship built in a British yard. Some months ago Sir W. G. Armstrong, Whitworth & Co., Newcastle, secured the contract for the first vessel, which it is understood will have a displacement slightly over 28,000 tons and a length of about 620 feet. Her armament will consist of ten 14-inch guns in five turrets and sixteen 6-inch guns. It is assumed that the second battleship will also be secured by the Armstrong Co., although it may be built at Barrow by Messrs. Vickers, Ltd., who are understood to have been associated with the Armstrong firm in the protracted negotiations which have been conducted with the Chilian Government.—*Shipping*, Illustrated.

The ships are practically sisters of the English *Orion* carrying heavier guns.

Six large destroyers, of a displacement of 1500 tons, a length of 320 feet, and beam of 32½ feet, with a battery of six 4-inch guns are being built. They are to steam 31 knots. Are fitted with three 18-inch torpedo tubes.

FRANCE.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Courbet	23,500	20	12 12-in., 22 5.5-in.	Lorient	Launched Sept. 23, 1911
Jean Bart.....	23,500	20	same	Brest	" Sept. 22, 1911
France	23,500	20	same	St. Nazaire	Laid down Aug. 1, 1911
Paris.....	23,500	20	same	La Seyne	" " Aug. 1, 1911
Bretagne.....	25,000	20	12 13.5-in., 24 5.5-in.	Brest	" " May, 1912
Provence.....	25,000	20	same	Lorient	" " May, 1912
Lorraine	25,000	20	same	A private firm	" " Aug. 1912

NEW FRENCH "DREADNOUGHTS."—The French Navy is following the lead of Great Britain and the United States by increasing the caliber and reducing the number of guns in her main batteries. The three new battleships, the *Lorraine*, the *Bretagne*, and *Provence*, of 23,500 tons, will carry twelve 13.5-inch guns, all placed on the longitudinal center line of the ship. This policy is the cause of much hostile criticism by the press and many naval officials, Admiral Daveluy being opposed to any gun greater than the 12-inch. They are reported to be designed to carry twenty-four 5.5-inch guns, and to have the twelve 13.5-inch guns in three turrets, four in each.

THE FOUR-GUN TURRET.—After tenaciously sticking to primary and secondary guns of smaller caliber than most of the first-class naval powers, France has suddenly—doubtless under the influence of its capable Marine Minister, M. Delcassé—decided upon mounting four 12-inch guns in each of the three turrets with which her new battleships are to be fitted. This is an experiment of first-class importance which will be closely watched by the rest of Europe, and by no one more closely than our own warship designers, who have steadily refused, so far, to depart from the twin-turret system of mounting. Although the authorities deny it, there has undoubtedly been trouble in regard to mounting three guns in the turrets of the Austrian *Dreadnoughts*. The gunmountings themselves are of extraordinary weight, and this difficulty will be greatly intensified if a fourth gun be added by our friends, the French. Yet their engineers have on many occasions startled the world by their ingenuity and practical proposals, and they may yet show the way in four-gun turrets without having any abnormal difficulties, outside of those which are bound to attach themselves to any such bold proposal as this. The smashing power of a comparatively short ship with three 4-gun turrets mounted on the middle line, would be enormous, as no less than twelve primary guns would be available for every broadside the captain wished to fire; while four-gun salvoes ahead or astern would also form a feature of the plan of concentration.—*United Service Gazette.*

SHIPBUILDING OF 1913.—There will be 51 war vessels under construction:

Eleven battleships.	One transport.
Fifteen destroyers.	One river gunboat.
Twenty-one submarines.	One despatch boat.
One mine layer.	

The large proportion of battleships is worthy of note, as is also the mine layer and gunboat. The ships that will be completed in 1913, and that will take their batteries before the first of January, 1914, number 19.

The two to be completed this year are the *Jean Bart* and the *Courbet*, which were launched respectively at Brest and Lorient in September last. These vessels are 540 feet in length, 88½ feet in beam, and at 29 feet draft displace 23,100 tons. The Parsons' turbine machinery, of 28,000 shaft horse-power, is to give them a speed of 20 knots. The five battleships now in progress are the *Bretagne* and *Provence*, building at Brest and Lorient, and the *France*, *Paris*, and *Lorraine*, building by contract, the first at St. Nazaire and the second at La Seyne. These are to be generally of the same dimensions as the *Jean Bart*, but 500 tons more is allowed for displacement on the same draft, and, in consequence, the power of the Parsons' turbines will be 29,250 shaft horsepower, to give 20 knots speed. Of the four new ships to be laid down, two will be commenced in the government dockyards on May 1, next year, and two at Brest and Lorient respectively on January 1, 1914. Although no official particulars are given regarding these vessels, it is understood that they will be larger than those now in progress, the displacement tonnage being about 25,500 tons, which will involve a further increase in power to ensure the same speed. As regards the armor, the thickness of the main broadside belt in the *Jean Bart* is 11 inches, tapering fore and aft, with 7-inch armor up to the upper deck, while the bulkheads are also of 7-inch armor. The gun-barbettes are of 10½-inch armor, and the secondary guns are placed on the broadside, behind the 7-inch upper belt. In the *Jean Bart* the armament includes twelve guns of 12-inch caliber, twenty-two of 5.5-inch caliber, and four 3-pounders. In the five later ships of the *Bretagne* type there will be ten 13.39-inch guns, twenty-two 5.5-inch, and four of 1.85-inch bore. There will be four submerged torpedo tubes. The complement of these ships is to be 34 officers and 1075 men. So far as the ships to be laid down next year are concerned, the prospects are in favor of corresponding armament, the 13.39-inch being regarded as sufficient.

No cruisers are provided for, and as regards the torpedo-boat destroyer program, nine vessels are to be completed next year, seven of them at private works, and two in the dockyards. Three will be "continued," and three will be laid down. The length of the later vessels in progress is 265 feet 9 inches, the beam being 25 feet 7 inches, and at 9 feet 10 inches draft the dispacement is 850 tons. These are twin-screw turbine-driven ships, and the armament includes two 3.9-inch and four 2.56-inch guns. Of submarine-boats, eight will be completed, ten continued, and three will be commenced. The submarines are steadily increasing in size. These latter vessels are to be 242 feet 9 inches long and of 19 feet 8 inches breadth. Internal-combustion engines of 4800 horse-power are to be fitted, in order that the boats may have a speed on the surface of 20 knots, a fact itself illustrative of the great advance made in this type of craft. There will be eight tubes for launching torpedoes, and the crew will include three officers and 37 men.

Certain miscellaneous ships are included. There is in progress a submarine-mine-laying ship called the *Cerbère*, of 566 tons, and with machinery of 6000 horse-power, to give a speed of 20 knots. The vessel will carry one 2.95-inch gun, and will be manned by a crew of three officers and 62 men. This vessel was put in hand at St. Nazaire on August 5 of last year. A transport named the *Seine* is also in progress, the displacement being 3160 tons and the speed 12 knots. Next year there is to be laid down a gunboat to be called the *Balny*, of 214 tons, to carry six 1.46-inch guns. Another special ship to be laid down is a despatch vessel, which will have a displacement of from 1600 to 1800 tons, with a speed of 17 knots. She will carry two 5.5-inch and six 2.95-inch guns. The total credit for new construction will amount to nearly 7¼ millions sterling for direct expenses, and £360,000 for miscellaneous expenses.—*Moniteur de la Flotte.*

FAST DESTROYER.—The destroyer La Dague made on its trials in the Lorient 33.118 knots. A bonus of 60,000 francs will be allotted the builders. —*La Vie Maritime.*

MINES.—A new model, the Harlé, torpedo and mine has been adopted, and the Navy Department has just ordered 1000 of these. The defence mine weighs 1100 pounds, and the blockade mine 880 pounds. The charge of gun cotton in each is 132 pounds. This mine is very convenient and can be employed where the current is very strong without inconvenience. The aim of a torpedo should never be, properly speaking, that of sinking a ship, but to injure it so severely that it will be out of action for several days at least. Calculations to this end show that a 132-pound charge of gun cotton is easily sufficient to stave in the double hulls of actual warships.

For mine layers the *Cassini* at Cherbourg and the *Casablanca* at Toulon have made trials. They were fitted to carry and lay 97 Harlé mines. They are fitted with a railway for launching purposes, and lay 60 mines per hour, 180 feet apart, on a cable of 9000 yards length. Fourteen knots speed was used in trials. The trials were not satisfactory, and the use of larger mine layers is being considered.—*Le Yacht.*

DEVICE TO RAISE SUBMARINES.—Experiments have been made at Cherbourg with a novel device to raise submarines. This consists of a watertight canvas bag or balloon that is attached to the hull of the submarine and filled with compressed air. Experiments demonstrated that a weight of 25 tons can be lifted in this manner.—*Marine Rundschau.*

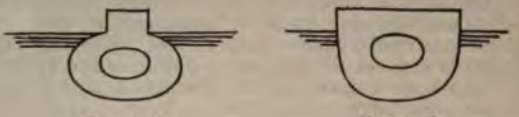
FORM OF SUBMARINES.—While the French still retain 30 per cent as the proper emerged volume in their submarines of 800 tons, the English are content with but 10 per cent for their submarines.

The English submarines are smaller in proportion than the French and their under-water navigation is easier and more comfortable.

This advantage is gained at the cost of inconvenience of surface runs, but the more one increases the size of the submarines, the more these difficulties disappear.

In England the form of the submarines is of an inverted mushroom. In France they are built like a destroyer.

The sketches show these forms, both types represented as making a surface run.



English French

The Italians have taken 15 per cent as the proper emerged volume, with the *Laurenti* type adopted in 1912. These look as do the French but are larger and deeper. The stern slopes into the water. The English are ordering vessels of the *Laurenti* type.—*La Vie Maritime.*

Cruiser *Foudre* has been fitted with a platform, between the funnels, for the stowage of the hydro-aeroplane *Ente.*

FRENCH NAVAL OFFICERS.—M. Delcassé has taken in hand the personnel of the French Navy, and especially designs to improve the position of the senior lieutenants. They are to have duties corresponding to their seniority and experience, and the first 120 on the list are to be assigned to special positions of responsibility. It does not appear that emoluments will be affected, unless the employments should bear special rates of pay. In another direction the Minister has adopted a measure which seems very wise in view of recent events in the French fleet. There is to be a special service of security in the larger ships, and in each vessel a commander or senior lieutenant will be responsible for the duties. In the ships of the *Danton* class, and in armored cruisers of more than 12,000 tons, the officer assigned to the duties or specially appointed will be a commander (*capitaine de frégate*) and, in ships of at least 9000 tons, a lieutenant. The commanders now in the *Dantons* are to transfer their present duties, and will be designated *chefs du service de sécurité.* The circular does not enter into the details of internal administration, and there is no indication of the manner in which the existing duties of these commanders are to be executed. In cases where there are to be two commanders the second will be appointed at once. The exact nature of the duties does not seem to have been defined, but they will doubtless be concerned with the repression of disorder, the prevention and discovery of cases of *sabotage,* and the care of various disciplinary matters.—*Army and Navy Gazette.*

PERSONNEL.—The following order was promulgated by M. Delcassé the 20th of May:

The increase of the number of duties in the sea-going life renders it more necessary than ever that the Department be informed very exactly on the special aptitudes of each of its senior officers, in order to assure the most efficient detailing of them.

I have decided, therefore, upon establishing individual records, and each commandant will be able, independent of the general value which he has formulated concerning the worth of an officer and of his manner of doing duty, to indicate in an exact manner for every captain under his orders: First, his aptitude for commanding afloat; second, if it should happen that a captain fills the duties of security officer, or second in command of a battleship, the ability of this senior officer to do the duties of second in command.

Also there will be a space to report for each officer serving at sea, the suitability of the officer to be appointed later to any special post as security officer.

The commanders of each naval force will be enabled, having this information on file, to form equally their personal opinions on points which should be indicated.

Considering the great importance that these estimates of officers will have as well for the officers themselves as for the best efficiency of the naval service, I do not doubt but that every officer having this honorable but delicate duty of commenting on his subordinates will know how to acquit himself with impartiality, firmness, and the truthfulness which is imposed by such a circumstance.—*Moniteur de la Flotte.*

THE FRENCH IN THE MEDITERRANEAN.—The decision of the French Government to maintain the two-power standard in the Mediterranean has been come to at an opportune moment, and not a day too soon. Since the war of 1870-71 the French people have had all their thoughts concentrated on perfecting their army, and they have accomplished this task so well that experts predict quite a different fate to that which befell it in the great war, should hostilities unhappily ever again break out with their Continental neighbors. If the same devoted attention is now given to perfecting her navy La Belle France will soon hold once more the power to cement the peace of Europe. Her plan with regard to the Mediterranean goes to show that even without the definite alliance which certain parliamentarians are at present clamoring for, the word of Great Britain is in France considered as good as her bond. It proves also that the policy of the two countries lies along the same course and that though not tied together like chariot steeds, the *entente* nations are content to run side by side in harmony, each working for the maintenance of the world's peace.—*United Service Gazette.*

THE FRENCH IN THE MEDITERRANEAN.—In view of discussions in the press and the debate in the House of Lords on the Mediterranean situation, a statement showing the present distribution of the French fleet, as recently reorganized, will not be without interest. The system adopted resembles in its broad features the organization of the British and German fleets, and answers to the ideas of Admiral Germinet and Admiral Lacaze, who was formerly chief of that officer's staff and is now chief of the Minister's Cabinet, as well as to the conception of Capt. Daveluy, expressed in his book "L'Esprit de la Guerre Navale." There are battle squadrons complete, with cruiser squadrons and auxiliaries, and the sea-going destroyers are where they are likely to find the enemy. The fleet in the Mediterranean with its base at Toulon includes the first and second battle squadrons. The first squadron is constituted of the six *Dantons* (*Danton, Condorcet, Diderot, Mirabeau, Vergniaud,* and *Voltaire*), and the second squadron of the *Patrie, République, Justice, Verité, Démocratie,* and *Suffren.* The attached cruiser squadron consists of the best armored cruisers, *Edgard Quinet, Ernest Renan, Jules Michelet, Léon Gambetta, Jules Ferry,* and *Victor Hugo.* There is also at Toulon the "first group" of the reserve squadron, which, however, seems at present to consist of one vessel only—the protected cruiser *Jurien de la Gravière*—and the armored cruiser *Waldeck-Rousseau* is at the port. It is anticipated that in the course of December the *Dreadnoughts Courbet* and *Jean Bart* will join the second battle squadron, when the *République* will go to the reserve and the *Suffren* will proceed to the North. Attached to the Mediterranean forces are about 40 destroyers. The first flotilla comprises 12 boats of 750 tons, and the second flotilla 12 of 400-450 tons. One-half of the latter, *i. e.*, an "escadrille" under a commander, is to be based on Ajaccio. The third flotilla comprises seven destroyers of the *Fanfare* and *Mortier* types, which are to be on the Algerian coast, and seven others with reduced complements at Toulon. There are also the mine layers *Cassini* and *Casablanca.* In

addition are, or soon will be, flotillas of submarines—each of six boats with a *capitaine de frégate* in command in a destroyer—at Toulon, Bizerta, and Oran, and these will be strengthened in December.—*Army and Navy Gazette.*

THE OCEAN AND CHANNEL.—It will be seen from the above statement that the flower of the French fleet is in the Mediterranean, and that the intention is to send the new ships to those waters as they are completed. The third battle squadron, which has its base at Brest, and normally has reduced complements, consists of the older battleships—*Charlemagne, St. Louis, Gaulois, Jauréguiberry, Masséna,* and *Bouvet.* The cruiser squadron, with full complements, consists of the *Gloire, Condé* and *Marseillaise,* and there is a group in reserve, with nucleus crews, at Brest, comprising the other armored cruisers—*Dupetit-Thouars, Gueydon, Amiral Aube,* and *Montcalm.* Attached to the squadron, and under the command of a captain, are two destroyer flotillas, each of 12 boats of which three-quarters have full complements. There are also submarine flotillas at Calais, Cherbourg and Brest, comprising about 30 boats of the latest classes, and to each flotilla a destroyer is attached. The old defensive flotillas now comprise only the older boats for local use, and have been brought under the orders of the naval prefects at the ports. The mine layers are the *Pluton, Cerbère, Hache, Massue, Baliste,* and *Flamberge,* which vessels have special complements.—*Army and Navy Gazette.*

LOSS OF THE "VENDÉMIAIRE."—This vessel was a *Laurenti* type submersible launched July 7, 1910, at Cherbourg. Dimensions: displacement on surface 398 tons, length 167 feet, beam 16.08 feet, twin screw, carrying seven torpedo tubes. On Saturday, June 8, 1912, the third squadron steaming from Brest was, at about 6.50 a. m., 5 miles N. 53 W. of Cape de la Hague, the Race of Aldernay, in which place it was to be attacked, according to a prearranged program, by the submarine flotilla of Cherbourg.

The lookout on the battleship *St. Louis,* the flagship leading, sighted dead ahead and close aboard the periscope of a submarine, which later proved to be the *Vendémiaire.* The alarm was given, but already the ram of the battleship had hit the submarine. This vessel sank at once in 59 fathoms of water. The engines of the battleship were backed and helm was put hard aport on the alarm, but it is estimated that the submarine's periscope was sighted but 150 yards ahead, and to cover that distance at 10 knots takes but 30 seconds. The spot was buoyed, but the strong currents carried the buoy away. The squadron waited an hour then steamed to Cherbourg leaving a cruiser and a destroyer behind. Lieutenant Prioul, Ensign Audie and 21 men were lost.

The strong currents are supposed to have carried the submarine further than was figured on by her commander, and the difficult navigation was the real cause of the disaster.

REPORT ON LOSS OF "VENDÉMIAIRE."—The commission of inquiry reports that the testimony of all witnesses agrees and the injuries to the ram show than the ram of the *St. Louis* struck abreast the tower of the submarine, the latter being cut in two. The forward part plunged to the bottom and disappeared, the after part remaining afloat an instant, then sank after chafing along the whole port side of the *St. Louis.* The depth of water was 53 meters or 29 fathoms. Great ebullition of air for as long as five minutes after the sinking of the submarine showed that she completely filled with water. There is no doubt but that all the crew died suddenly. The currents have drifted the submarine and the commission decides that it is absolutely of no use to try to raise her.—*Moniteur de la Flotte.*

M. Laubeuf, formerly of the French Navy, and one of the principal inventors of submarines, commenting in *Le Yacht* on the recent *Vendémiaire* disaster, says that the bigger submarines become the more probable is it

that disasters will occur. Although he instances the difficulty of the makers of internal combustion motors in keeping pace for practical purposes with the higher horse-powers necessitated by increased displacement of submarines, his main argument is based on the fact that naval tradition is so strong that any officer in command of a detachment of submarines insensibly adopts the combined formations which obtain with above-water ships. He argues that with small submarines the risks then incurred were less than with large ones. On the other hand, he contends that the whole principle of submarines working together is entirely wrong, and more or less responsible for most of the disasters that have occurred in the various navies.

M. Laubeuf's contention is that every submarine ought to be regarded as an individual unit, fighting without regard to its consorts. He even suggests that anything in the nature of co-operation is a weakness—the presumption being that supposing two submarines of a conventionally worked flotilla to be discovered, the positions of all the rest are likely to be located therefrom. As regards the *Vendémiaire* disaster itself, he points out that for practical purposes submarines maneuvering in peace-time are compelled to encounter war risks. In mitigation of such, he suggests that maneuvers when there is any fog about should be strictly forbidden, as a periscope in a fog is hopelessly unreliable to anyone attempting to estimate a distance with it. His second argument under this head is that it is fatal for a ship chancing to sight a periscope to do anything in the way of seeking to evade it by altering course. His ground for this opinion is that it is practically impossible to tell the direction of the submarine from merely sighting the periscope, and that the only course for the big ship is immediately to go full speed astern. On these lines, he thinks, submarine disasters from collision could mostly be averted.—*United Service Gazette.*

COMMENTS ON CAUSE OF LOSS OF "VENDÉMIAIRE."—The *Moniteur de la Flotte* says that poor periscopes can be blamed for her loss and for that of the *Pluviôse*. All commanders of submarines complain of their periscopes, those furnished ten years ago were excellent, those provided now—unbelievable fact—are poorer and poorer. Those given to the new vessels are less clear than those given to the *Morse, Algérien,* etc! A good periscope should be clear, strong with magnifying power at least one; those supplied are not clear and their power being less than one makes objects appear more distant than they are. Submarines have bent their periscopes in plunging, showing the weakness of these instruments.

EXERCISE AT RAISING A SUBMARINE.—On June 23 at 3 p. m., Admiral Cocheprat, prefet maritime of Brest, sent word out that a submarine had just sunk in 10 fathoms of water in the roadstead near île Lougue. One-half hour later all the arsenal tugs with lifting chains, diving apparatus and crews were on the spot, ready for raising a vessel.

ACCIDENT ON "JULES-MICHELET."—During gunnery instruction firing on June 26 two flarebacks occurred. The first was in 6-inch turret No. 2, where at 3.40 p. m., at the 49th shot of a 6-inch gun, after an interruption in the firing of 3 to 4 minutes and succeeding a slow rate of firing of an average of 1 minute and 20 seconds between shots, the shell being in place for next shot, the two cartridge bags of the charge caught fire when inserted. The crew of the turret ran out with their clothes on fire. Three men died, and many others are badly hurt.

Reduced charges, made especially for schoolships, were in use.

The second happened under identical conditions about 6 p. m. the same date in 6-inch turret No. 6, where, after firing 113 shots, the very same accident as above took place. The mean interval of firing had here been 1 minute 43 seconds.

The powder belonged to a lot made at Saint Médard in 1910, and was above suspicion.

Gas expelling devices were fitted and working well, so the cause assigned is the heating of the gun.—*Moniteur de la Floite.*

The sailor men have but one opinion, *i. e.,* that the powder was bad.

NOTES ON THE ACCIDENT.—*Le Yacht* says that the powder used in the recent target practice was all in a condition of very doubtful stability emitting the odor of bananas. It was not put in the magazines until the very last minute, and every precaution taken to prevent a fire.

The powder used, however, is stated to have been delivered as having high stability, was BM_2 and AM_5 made at Saint Médard in 1910.

There were six men who died as a result of the accidents and 14 men were badly burned, and suffered the usual lung trouble.

We recall that the powder B is a mixture of two kinds of nitrocellulose.

Those interested in French powders may consult pages 1281 and 1282, of No. 140, for a description of their manufacture and composition.

The gas in guns might have been incompletely burned, due to the reduced charge. The block remained open. The gas had been blown out once by compressed air, and again after the shell had been seated.

Thus it is difficult to believe any gas remained, the chamber had been sponged, and the gun could not have been very warm.

The first section of charge was inserted, the loader with the second was coming up when the first was distinctly seen to take fire, slowly at first, then bursting into flames. There must then have been spontaneous decomposition and inflammation of the powder. Very fortunately the ammunition hoists are fitted with automatic shutters, for without these the flames would have spread and lighted other charges in the passing chambers.

The 8 per cent amyl alcohol is considered by Colonel Lepidi not as a stabilizer, but as a most satisfactory masker. In fact it might well be the agent which helped the ignition of the powder.

In consequence of the accident on the *Jules Michelet*, no firing will take place until further orders in which cartridge bags are used. The competitive firing of the fleet will therefore not take place after the maneuvers in July.

La Vie Maritime remarks relative to this disaster on the *Jules-Michelet* that MM. Delcassé and Millerand were astounded and shocked at the terrible accident. New and stable powders bursting spontaneously into flame like old and remixed ones! There is plenty here to wonder at as our official experts proclaim the excellence of our powders. The naval service and the powder makers no longer know what to think.

The Minister of Marine did at once what he ought to do: Ordered for immediate trial 5 tons English powder, 5 tons Italian powder, 5 tons Swedish powder.

THE OFFICIAL INVESTIGATION.—General Gaudin, head of this court, has reported the first results to M. Delcassé, and is to further investigate the central laboratory, those at Seivan-Livy, and at Gavres. From first examination of the powders we deduce:

1. The accident cannot be assigned to spontaneous ignition of the powder resulting from decomposition thereof. The powder is essentially one of high stability.

2. The ignition of the charge was not due to the high temperature of the powder chamber walls.

3. The place to look for the trouble is (a) in the solid residue of combustion, (b) in the inflammable gas produced by the combustion of the charge for the previous shot, which gas may not have been entirely driven out of the bore, (c) in the volatile matter given off normally by the powder and carried by the charges themselves under certain conditions.

Moniteur de la Flotte says that the last theory is the only possible one. Let us assume that amyl alcohol emits an inflammable gas. There will be in this event two compounds, nitrite of ammonium which explodes at 50°, and nitrite of amyl, susceptible of starting the fire at a low temperature in contact with water or air of high humidity. The serge of the cartridge bag was perhaps thoroughly soaked with volatile matter, and we see the probability of using in place of serge, a fusible metallic case proof against the amyl and ammonium nitrites.

It is perhaps worthy of remark that the powders designated for shore use have only 2 to 3 per cent of amyl alcohol, in place of the 8 per cent. This accounts for the few accidents with powder in the War Department.

THE FRENCH MANEUVERS.—The vessels sailed from Toulon at 2 p. m. on July 16 and comprised the following:

First squadron, 6 *Dantons.*

The second squadron, 5 *Patries,* 1 *Suffren.*

The light squadron, 2 *Waldeck-Rousseau,* 3 *Jules Ferry,* also the *Jurien de la Graviere* in place of *Ernest Renau.*

Five squadrons of destroyers.

One squadron of submarines.

In addition the torpedo-boats and submarines of the local defences of Toulon and Bizerta were engaged. The maneuvers took place between Toulon, Corsica, Bizerta, and Algeria. The *Foudre,* with her hydro-aeroplane, was also used.

The Mediterranean exercises began early on July 17. The whole force was in command of Admiral Lapeyrère who, last year, commanded one of the squadrons. M. Delcassé was on board the *Edgar-Quinet* and witnessed the whole of the operations.

The Red (enemy) fleet was supposed to be steaming for Corsica with the object of establishing a base thereon. Admiral Moreau, on the *Justice,* sailed from Bregançon with the second squadron and two torpedo flotillas forming the Red fleet. He reached Ajaccio at 4 p. m.

The commander of the Blue fleet had dispatched cruisers to the Hyères Islands, where, failing to find the Red fleet, he steamed to intercept it, the smoke of it being sighted more than ten miles in its rear. The cruisers could not stop the Red fleet on account of insufficient force, and the Red fleet anchored in the harbor of Ajaccio after overcoming the difficulties of a very deep harbor and the presence of some hostile destroyers which were driven off after an artillery duel. Admiral Moreau led his fleet out, all lights screened, during the night shortly after 11 p. m., in order to break the blockade established by the French fleet shortly after he had entered Ajaccio. The French destroyers on the blockade were found to be close in and a destroyer fight ensued. The squadron itself steamed out without meeting any large vessels, it having sent one of its destroyer flotillas to the attack of the French fleet. Admiral Moreau thus broke the blockade successfully. The Red fleet returning under radio instructions engaged in a running fight in parallel columns at 4 a. m. with the main French fleet. After its anchoring, the submarines attacked the Red fleet. Destroyers cruised outside the jetties and signalled the passage of the submarines to Admiral Moreau. They were usually detected in season by the wash of their periscopes, for the sea was calm.

On the afternoon of the 18th the Reds sailed and fought the French fleet led by Admiral Gauchet in the *Mirabeau* with six battleships and three cruisers. Steamed in parallel courses at 10,000 yards then closed to 8000, then to 6000, and the Red cruisers then attempted to T the French squadron, concentrating all fire on the flagship, which the destroyers attacked briskly, the opposing ones being too far ahead. The action then closed, and the combined fleets maneuvered at 16 knots for battleships and 20 knots for cruisers. During the night torpedo attacks were repelled.

On the 19th the fleet was again divided as formerly, Blue under Admiral Bellue, composed of first squadron, first cruiser division, first, second and fourth torpedo flotillas; Red, under Admiral Moreau, composed of second squadron, second cruiser division, and third and fifth torpedo flotillas. The Red fleet steamed to north, the Blue to the south. When the Red sighted the Blue, the Red was steaming in line of sections, and the Blue was distant about 15,000 yards. At 8000 yards the Red changed course 8 points to starboard by section thus allowing all his heavy guns to bear. The Blue at this time can use but the guns of its first four vessels, the others using after guns only. The range closed continuously. The flotillas of the Blue fleet are too near the Red and are beaten by the heavy fire of the Red

fleet which found itself more and more massed on the head of the Blue column. The battle takes a very favorable turn for the Red which gained the initial tactical advantage. Here happened the final incident which gave the Red the battle. Suddenly the second cruiser division left the column and by a wide turn to port attacked the rear of the battleships of the first squadron. The moment was bad for the latter, she is about to be beaten in front by the battleships of the Red, and will undergo a fire from astern by the cruisers. The Blue makes an error and detaches the two rear battleships to engage the attack of the cruisers. While thus reduced to four, the Blue finds that it cannot sustain the attack of the six Red battleships. The cruiser division of the Blue in head of column appeared to do nothing but prolong the line. The artillery fight thus took 35 minutes, resulting in a victory for Admiral Moreau in the Red fleet.

The fleet then proceeded to Algiers and Bizerta. Several engagements in tactics occupied the remaining days. The signals most favored for battle were "cruisers T the enemy," "destroyers charge the head of the column." Again the utility of movements by sections by which the Red in a former engagement had obtained the advantage was brought to light. The advantages of having fast wings simulated here by destroyers were brought out strikingly, and the French press deems there is a need for the battle-cruiser and for the 5000-ton fast cruisers which can disperse the torpedo flotillas while scouting. The *Foudre*, with its aeroplane, was brought in use the last two days, though it is not mentioned in detail by the press. These maneuvers continued for one week.

GERMANY.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks.
Battleships					
Oldenburg	22,400	21	12 12-in., 14 5.9-in.	Dantzig (Schichau)	Commissioned
Kaiser	24,500	21	10 12-in., 14 5.9-in.	Kiel (Kaiserliche)	Launched Mar. 22, 1912
Friedrich der Grosse	24,500	21	same	Hamburg (Vulkan)	" June 10, 1911
Kaiserin	24,500	21	same	Kiel (Howaldt)	" Nov. 11, 1911
Prince Regent Leopold	24,500	21	same	Germania Works	" Feb. 21, 1912
König Albert	24,500	21	same	Danzig (Schichau)	" April 27, 191.
Ersatz K. F'd'h Wilhelm	27,000	21	10 14-in. (probably)	Hamburg	Laid down Nov., 1911
Ersatz Weissenburg	27,000	21	same	Bremen	" " Nov., 1911
Ersatz "S"	27,000	21	same	Wilhelmshaven	" " July, 1911
" "A"	27,000	21	No details	Germania	Projected
Battle-Cruisers or Cruisers of the Line					
Goeben	22,600	27	10 11-in., 12 3.4-in.	Hamburg	Commissioned
Seydlitz	22,600	27	same	"	Launched Mar. 30, 1912
"K"	....	..	(?)	"	Laid down June, 1911
Ersatz Kaiserin Augusta	....	..	(?)	Dantzig	Authorized
Protected Cruisers					
Breslau	5,000	29	2 5.9-in., 10 4.1-in.	Stettin	Launched May 16, 1911
Magdeburg	5,000	29	same	Bremen	" May 13, 1911
Stralsund	5,000	29	same	"	" Nov. 4, 1911
Ersatz Strassburg	5,000	..	....	Wilhelmshaven	" Aug. 24, 1911
Ersatz Seeadl'r	5,000	..	....	Germania	Building.
" Seier	5,000	..	....	Howaldt	"

"KAISER" CLASS.—The increase of size in this class over the *Oldenburg* type is devoted to increasing the steaming radius entirely.

BATTLE-CRUISERS.—The official name given these cruisers in Germany is Linienschiff Krewzer or cruisers of the line.

SPEEDS OF MEN-OF-WAR.—Battle-cruiser *Goeben*. In her first steaming trials just completed a maximum speed of more than 30 knots was reached. This places her as the speediest German man-of-war with the exception of destroyers and the small cruiser *Breslau*. The speed of the English battle-cruiser *Lion*, as finally corrected, was 28 to 28.7 knots; that of the *Moltke* was 29.5 knots maximum and 28.4 knots since her commissioning. The *Breslau*, on April 20, 1912, made 30.4 knots. The *Von der Tann* made a maximum of 28.1 knots. The torpedo vessel *G-194* made 36 knots in September, 1911. The battle-cruisers of Germany were all built by Blohm & Voss, of Hamburg, and are all fitted with Parsons' turbines. The small

BATTLE-CRUISER "GOEBEN."

cruiser *Breslau* has turbines of type A. E. G., and the torpedo vessel *G-194* has turbines of type *Germania*. The *Goeben* is now undergoing her official acceptance trials.—*Internationale Revue*.

According to reliable reports the German cruiser *Moltke* never achieved the record speeds attributed to her by the daily press. She is good for 27 knots, but has never exceeded that to any extent. It is also stated that as a steamer she is behind the *Von der Tann*, which ship, by the way, never did so well, relatively speaking, as the *Blücher*. The *Blücher* appears to be one of the most successful ships ever built. Her armament is nothing much, but it needs an *Indomitable* to defeat her. She is not very appreciably slower, and she cost about half as much as *Dreadnought* cruisers do. On paper she makes but a poor show—but paper superiorities have a knack of disappearing into the *ewigkeit* what time stern practice is the only criterion.—*The Engineer*.

SPEED OF "OLDENBURG."—*Oldenburg* made 22.2 knots on trial near Dantzig.

The Germans announce that the battle-cruiser *Goeben*, sister to the *Moltke*, has made a speed of 30.5 knots, which is thus the record for large vessels. Some doubts are held as to this. The Germans do not admit it willingly, but the *Lion* made 31.7 knots upon at least one of her runs, and we are not at all sure after her alterations but that she will again make a speed over 31 knots.—*Le Yacht.*

"GOEBEN."—Turbine battle-cruiser *Goeben*, off Cuxhaven on May 18, made 30.5 knots an hour over a measured course. This vessel has Parsons' turbines. The dimensions of this vessel are now given as follows:

Length, 609.08 feet; beam, 96.76 feet; draft, 26.9 feet; displacement, 23,000 tons; horse-power, 52,000; designed speed, 28 knots; coal capacity, 3100 tons; boilers, 24; crew, 1013; armament, ten 11-inch 50-caliber, twelve 6-inch 45-caliber, 4 submerged torpedo tubes.

The new German cruisers of the *Breslau* class—*Breslau*, *Strassburg*, *Stralsund*, and *Magdeburg*—of 4700 tons odd, have generally been reported as carrying 6-inch guns. It appears, however, that this is not so—they are simply larger sisters of their immediate predecessors. The armament remains at twelve 4.1-inch guns, and the increased displacement all goes in superior engine-room efficiency. In this connection the new cruisers differ from their sisters, since instead of three funnels they have four. There are also certain minor alterations—the aftermost pair of guns being carried at an increased height and the form of the bow is varied very considerably.—*The Engineer.*

SIZE OF GUNS.—In Germany public opinion now strongly favors guns of large caliber. Though one recalls that even as late as 1901 the maximum caliber of battleships was the 10-inch, and about that date the Imperial Navy adopted the 11-inch with the *Braunschweigs*. This caliber was used for the *Nassaus*, started in 1907, and was only abandoned in favor of the 12-inch with the *Helgolands*. That caliber was retained in the *Kaisers*. The public press, and Count Reventlou reproach Admiral Von Tirpitz for not immediately conforming to the English when, in 1909, they adopted the 13.5-inch gun, and for not having pushed the construction of the 12-inch guns with sufficient energy to the end that the *Nassaus* could have had them. —*Le Yacht.*

COALING RECORDS.—Recently it was stated that the *Helgoland* had loaded 1100 tons of coal in two hours.

For many months certain statements have appeared in the German press regarding the rapidity with which German battleships are coaled. Certainly records of 500 and 600 tons per hour are most creditable and indicate a high state of efficiency as far as the coaling party is concerned. But for practical purposes it must be remembered that most of this coaling is done in bags sent alongside, already filled, from the shore, and with the assistance of practiced coaling gangs. There is no filling of bags in a collier's hold and subsequently transporting them with a Temperley transporter, which is all done, incidentally, by the ship's company only in the Royal Navy. The dockyard coaling system in Germany is brought to a fine standard; in war time it will devolve on the ship's company to take in what coal they can get wherever possible, and these records probably represent three times what could then be done.—*The Engineer.*

THE GERMAN NAVY.—The German new construction program for the next six years comes out as follows: 1912 (two ships): Battleship in replacement of the *Brandenburg*, and large cruiser to be known at present as the *L*. 1913 (three ships): Augmentation on additional battleship, battleship in replacement of the *Wœrth*, and large cruiser in replacement of the *Hertha*. 1914 (two ships): Battleship in replacement of the cruiser *Kaiser Friedrich III*, and large cruiser in replacement of the *Victoria Luise*.

1915 (two ships): Battleship in replacement of the cruiser *Kaiser Wilhelm II*, and large cruiser in replacement of the *Freya*. 1916 (three ships): Augmentation on additional battleship, battleship in replacement of the *Kaiser Wilhelm der Grosse*, and large cruiser in replacement of the *Hansa*. 1917 (two ships): Battleship in replacement of the *Kaiser Barbarossa*, and large cruiser in replacement of the *Vineta*. A second flotilla of submarines will be brought into service in the autumn; this will bring the number of these small vessels owned by Germany to twenty-four. A third flotilla of twelve submarines is in contemplation.—*Engineering*.

It is to be noted that in the above program many of the new ships are far greater in power than those which they replace.

All new German construction awarded this year went to the Baltic yards. The *Ersatz Brandenburg* to Germania works at Kiel.

The armored cruiser *Kaiserin Augusta* to the shipyard Schichau at Dantzig. Of the smaller units the imperial dockyard of Kiel will build the cruiser *Ersatz Prince Wilhelm*, and Vulcan works of Stettin the cruiser *Ersatz Irene*. Twelve destroyers will be built at Schichau, and six submarines at Germania works at Kiel.—*Internationale Revue*.

NEW DOCKYARD.—A dockyard will be established at Cuxhaven to afford accommodation for vessels of the largest size. At present it is made use of only for those vessels which cannot be berthed at Wilhelmshaven.

BUDGET.—This provides that in 1914 the army will consist of 688,100 men, who are divided into 544,200 men and petty officers, and 97,600 under officers, 13,200 one-year volunteers, and 33,100 higher and general officers. The fleet will comprise 80,000 sailors, petty officers, and officers.—*La Vie Maritime*.

GERMAN MANEUVERS.—The spring maneuvers of the high sea fleet lasted about six weeks. Few details are available. The fleet was composed of 16 battleships, four armored cruisers (*York, Blucher, Von der Tann* and *Moltke*), five smaller cruisers, four destroyer flotillas, one submarine flotilla, and two divisions of mine layers.

A first series of exercises took place in the North Sea, and a second on the coast of Denmark off Skagen, after which the second squadron went to Wilhelmshaven and simulated a landing at the mouth of the Ems. The troops stationed at the isle of Borkum, which commands the Ems, were warned of the landing while away at target practice. They reached the port of Emden by forced marches, all the steam vessels were seized and they embarked. Steamers came from the islands of Sylb and Helgoland with marine artillery. The troops were disembarked and the island successfully defended.

ACCIDENTS.—The collision of torpedo-boat *G-113* with the battleship-cruiser *Friedrich Karl* happened during the night in maneuvers. The blow was so violent that the bow of the torpedo-boat for a length of seven feet was completely folded back. The cruiser sustained negligible injuries. As for the boat her hull was not torn as the fold, and she was able to gain Kiel without making water, and from there to return under its own steam to the Wilhelmshaven shipyard where she is going to be repaired. Although the injury was very great, the German steel used in the construction of torpedo vessels as in battleships has proved to be of a great resistance and of remarkable tensile strength. The steel was not ruptured. The collision occurred in the exercise of running a channel by the torpedo-boats. This maneuver, of which the details are held secret in the interests of national defence, puts a strong test on the quality of the matériel and on the skill of the crew. It is the more difficult because, in night attacks, the torpedo-boats, as well as the enemy's vessels, navigate with all lights out. The German torpedo-boats enjoy a justly earned reputation for being a strong

arm, and hence it is necessary that they occasionally pay the cost necessary to keep this reputation.—*Ueber die Gesamten Armeen und Flotten.*

One of the small boats belonging to the German battleship *Thüringen*, which was anchored with the rest of the second squadron of the active fleet in the Kurisches Haff, capsized July 22 while it was taking officers back to the vessel from shore, two officers being drowned. Eight others were brought ashore unconscious, but were resuscitated. Another pinnace loaded with bluejackets belonging to the fleet also was wrecked in the surf, but all were saved.

The German battleship *Hessen* rammed a torpedo-boat while the smaller craft was crossing the bows of the big warship during a night attack off Kiel July 19. Three members of the torpedo-boat's crew were killed. The damaged vessel was towed to Kiel harbor for repairs.—*Army and Navy Journal.*

GREAT BRITAIN

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Thunderer	22,500	21	10 13-5-in., 16 4-in.	Thames Iron Works	Commissioned June, 1912
Conqueror.....	22,500	21	same	Beardmore	" Sept., 1912
Ajax.....	23,500	21	same	Scott (Greenock)	Launched March 21, 1912
Audacious.....	24,000	21	same	Cammel Laird (Birkenhead)	Building
Centurion.....	24,000	21	same	Devonport	Launched Nov. 18, 1911
King George V	24,000	21	same	Portsmouth	" Oct. 9, 1911
Benbow	26,000	22	10 13-5-in., 16 6-in.	Beardmore	Laid down May 30, 1912
Delhi.....	26,000	22	same	Vickers	" May 31, 1912
Iron Duke.....	26,000	22	same	Portsmouth	Building
Marlborough..	26,000	22	same	Devonport	Building
Battle Cruisers					
Princess Royal	27,500	28	8 13-5-in., 16 4-in.	Vickers	Undergoing trials
Queen Mary...	28,850	28	same	Palmer	Launched March 20, 1912
Tiger.....	28,850	30	same	Brown & Co.	Building
Australia.....	18,750	25	8 12-in., 16 4-in.	"	Launched Oct. 25, 1911
New Zealand..	18,750	25	same	Fairfield	" July 1, 1911
Protected Cruisers					
Chatham	5,500	25.5	8 6-in.	Chatham	Launched Nov. 9, 1911
Southampton..	5,500	25.5	same	Brown & Co.	Building
Dublin	5,500	25.5	same	Beardmore	Launched Apr. 30, 1912

TRIALS OF BATTLE-CRUISER.—The battle-cruiser *Princess Royal*, built by Messrs. Vickers, Son & Maxim, will leave Barrow for Devonport on July 16, carrying out preliminary and anchor trials on the passage. After being docked her gun and torpedo trials will take place on September 6 and 7; on September 9 her twenty-fours hours steam trial with runs on the Polperro mile course will be carried out, and on September 12 her full power and other trials. She will then be docked again, and on September 21 off Polperro she will run mile trials at three-quarters and full power.—*United Service Gazette.*

THE "PRINCESS ROYAL."—Captain Osmond De B. Brock, Assistant Director of the Mobilization Division of the Admiralty War Staff, will, on August 1, take over the command of the new battle-cruiser *Princess Royal*, which has been built by Messrs. Vickers, Limited, at Barrow-in-Furness, and will be ready shortly to carry out her official steam trials. The *Princess*

Royal was laid down at Barrow on May 2, 1910, and is a sister ship to the battle-cruiser *Lion*, flagship of the first cruiser squadron. She has been built with a length of 660 feet, and a displacement of 26,350 tons, whilst her turbines are of 70,000 horse-power, estimated to propel her at a speed of 28 knots. The *Princess Royal* would have carried out her trials in May last, but has been delayed for alterations to be made in her similar to those made in the battle-cruiser *Lion*. The cost of the *Princess Royal* will exceed two millions sterling.—*United Service Gazette.*

H. M. S. "CONQUEROR."—The latest of the British battleships so far constructed—the *Conqueror*—has completed her steam trials, and these have yielded most satisfactory results. The speed attained on the full-power trials on the measured runs exceeded the rate achieved by any *Dreadnought* battleship in the British Navy, and, indeed, any battleship of the same fighting power in any foreign country. The *Conqueror* on her trials attained a mean speed of 22.126 knots, whereas the sister ship—the *Thunderer*—got 20.08 knots; the *Monarch*, 21.88 knots; and the *Orion*, 21.02 knots. The speed aimed at in these various ships was 21 knots, but the propellers are different, and there is a reserve of steam power to meet contingencies in service. In the case of the *Conqueror* the vessel was run for a short time, when at sea, at a power considerably in excess of that required by the contract. The designed power of the machinery was 27,000 shaft horse-power, and on the eight hours trial the actual mean was 28,430 shaft horse-power, the two starboard turbines developing 14,380 shaft horse-power, and the two port turbines 14,050 shaft horse-power, the mean revolutions of all four shafts being 322 revolutions per minute. The steam pressure at the boilers was 230 pounds, and at the engines 217 pounds, the vacuum being 28.3 inches, with a barometer reading of 29.82 inches. The coal consumption throughout the trial was 1.74 pound, which is very satisfactory. During this trial six runs were made over the measured course at Polperro, and on these runs the machinery worked with marvellous regularity, the variations in the mean revolutions of the turbines being between 338 and 340.5 revolutions per minute. The speed attained varied very little, the rate in these six successive runs being 22.962 knots, 22.109, 22.133, 22.133, 22.133, and 22.109, giving a mean speed of 22.126 knots, which, as we have said, is the highest speed in any ship of the class to which the *Conqueror* belongs.

On the 30 hours coal consumption trial equally satisfactory results were got. The mean power developed was 19,081 shaft horse-power, almost exactly equally divided between the two starboard and the two port shafts. The boiler pressure was 226 pounds, the vacuum 28.6 inches, with a barometric reading of 29.57 inches, while the coal consumption was notably low. Six runs were also made on this trial, and the mean speed was 19.36 knots. Equally with this and the full-power trial the ship was loaded to her service draft, and the stokeholds were under practically natural draft conditions, no difficulty being experienced in maintaining full steam pressure. So there is no doubt that, so far as the design is concerned, the machinery is highly satisfactory.

There are eighteen boilers in the ship, of the Babcock & Wilcox type, and the ratio of heating surface to grate area of 35 : 1, while 2¼ square feet of heating surface is provided per unit of power. The turbines are of the Parsons' type, mounted on four shafts, there being two high-pressure ahead turbines and two low-pressure ahead turbines, while the astern turbines are also arranged similarly in series, there being two high-pressure and two low-pressure. But whereas the high-pressure ahead and astern turbines are in separate casings, the low-pressure ahead and astern turbines are, in each instance, arranged in one casing.

The *Conqueror*, which is of 22,500 tons displacement at a draft of 27 feet 6 inches, has a length between perpendiculars of 545 feet, a beam of 88 feet 6 inches, and a depth moulded of 43 feet 6 inches. The ship is fitted with ten 13.5-inch breech-loading guns, placed in pairs in barbettes, so arranged on

the center line that all five can be fired on every broadside, and that, in addition, there is an auxiliary armament having a combination of 6-inch and 4-inch guns. The *Conqueror* has been built and engined by Messrs. William Beardmore & Co., the keel having been laid on April 5, 1910, but the construction has been delayed owing to labor troubles. The firm are to be congratulated on the success of the performances of the ship and well merit the confidence shown by the Admiralty in placing with them the order for the battleship *Benbow*, provided for under the program of 1911-12.—*Engineering.*

The British battleship *Conqueror*, on the eight-hour trial at full power June 7, made a speed of 23.25 knots instead of the 21 knots as stipulated in the contract. The fastest British battleship hitherto was the *Vanguard*,

BRITISH BATTLESHIP "CONQUEROR."

which did 22.1 knots on her trial two years ago. The fastest German battleship is the *Oldenburg*, which attained a speed of 22.4 knots.—*Shipping*, Illustrated.

"CENTURION" (BATTLESHIP), BUILDING AT DEVONPORT.—The armor plating for the conning-towers has been delivered. The foremost tower will be of an enlarged pattern, so constructed as to serve as a fire-control and Whitehead observation station, and the after one, of smaller dimensions, will serve as an observation and Whitehead control station for the stern fire. The grouping of the forward armor forms a combination of exceptional strength, and presents either inclined or curved surfaces to practically all angles of fire, the center of the combination being occupied by the 13.5-inch barbette redoubt.—*Army and Navy Gazette.*

In the *Centurion* an armored battery and a super-imposed armored casemate is to be introduced for the auxiliary armament. The positions of the masts will have to be changed and a reversion to single masts is expected, as is evidenced in the *Lion.*

NEW TYPE OF GUN.—The first keel plate of the battleship *Delhi* was laid in July at Vickers' naval construction works at Barrow. She will represent the latest super-*Dreadnought* type and will have the newest 13.5-inch guns, throwing shells of 1400 pounds, against 1250 pounds of the old 13.5-inch guns, and equal to the latest 14-inch gun of the American Navy. She will also have sixteen 6-inch guns and many smaller ones with long range. Her speed will be twenty-two to twenty-three knots.—*United Service Gazette.*

ANTI-ROLLING TANKS.—The *Centurion* will have these as well as large bilge keels. The *King George V* has had them fitted and the *Iron Duke* is to have one of the Frahm type similar to those of the Cunarder *Laconia*. These tanks consist of a floating tank in an outer tank. The principle of the method being that of attaching a second pendulum to a swinging pendulum at its bulb and then a third pendulum to the bulb of the second pendulum. The motion of the first pendulum is conceived to be that of the waves of the sea, the second pendulum is that of the tank free to float inside the ship and the ship itself becomes the third pendulum and no rolling is transmitted to the ship in any sea.

BATTLE-CRUISER "LION."—The alterations that were necessitated by the heat from the foremost funnel having been found so great in the course

BATTLE-CRUISER "LION" BEFORE RECONSTRUCTION.

of the first official steam trials than when all the boilers were in use it twisted some of the fittings on the navigating bridge, warped the woodwork, generally made the conditions unbearable for those on duty there, and the heat from the funnel seriously affected the ship's compasses and other delicate instruments on the bridge and in the fire-control platform which forms part of the tripod mast, were completed and the vessel commissioned June 4 for service in the first cruiser squadron. She now, as is seen from the illustrations, has pole masts and the largest and longest funnel of any battle-cruiser. The fire-control gear is housed in the conning-tower.

She is the first finished English warship to cost over two millions sterling. The total expenditure has been £2,057,708 or $10,000,460.

She is the largest completed warship in the world, being 50 feet longer than the German battle-cruiser *Goeben*, and 3800 tons heavier than the British battleship *Orion*. Her actual dimensions are: Length, 660 feet; beam, 88.5 feet; normal draft, 28 feet; displacement, 26,350 tons. Her Parsons' turbines are of 70,000 horse-power, designed for a speed of 28 knots.

The *Lion* is the first cruiser to be completed armed with the 13.5-inch gun. Eight of these weapons are mounted in four turrets on the center line, the second from forward being raised to fire over the foremost. Four guns thus bear ahead, two astern, and eight on either broadside. Two 21-inch torpedo tubes are fitted, and sixteen 4-inch guns are mounted for keeping off torpedo craft. The main armor belt is 9 inches thick amidships.

THE RECONSTRUCTED "LION."—No one has a favorable word to say of the battle-cruiser *Lion's* appearance, now that she is again at sea, writes a naval correspondent of *The Globe*. Originally she was characterised by one expert as "the ugliest vessel in the British Navy," but in point of comparison she was handsome six months ago to what she is now, with the foremost and center funnels much closer together than the center and after funnels, the two pole masts (there is no tripod) disposed unlike anything to which the eye is accustomed, and the conning-tower enlarged so much that it detracts from the few graceful lines which the vessel originally possessed. The only redeeming feature about the alterations, so far as they relate to the appearance of the *Lion*, is that the three funnels are symmetrical; instead of the foremost one being almost oblong, it is now oval, and the other two, which were stumpy, have been raised to a height uniform with the new one. How the modifications will answer remains to be proved during the forthcoming maneuvers; but one thing which is certain is that the "spotter" will not run the risk of being suffocated by the control position being placed, as it formerly was, abaft the foremost funnel. The mast which carries the control platform is now before the funnel, where in most conditions of weather it will escape the fumes from the uptakes. The alterations to the *Lion* and her two sister ships are estimated to cost quite £70,000, and will be a charge upon the supplementary estimates. —*Page's Weekly*.

BATTLE-CRUISER "LION" AFTER RECONSTRUCTION.

H. M. AUSTRALIAN CRUISER "MELBOURNE."—The launch of the cruiser *Melbourne* at Cammell, Laird & Co.'s works at Birkenhead has special significance, as it marks a new and definite naval policy undertaken by one of the Dominions of the Crown. The new Australian Navy, of which the *Melbourne* will form part, will comprise modern cruisers, torpedo-boats, and submarines. It will further necessitate the maintenance by this colony of training establishments, dockyards, and factories. The *Melbourne* was designed by Sir Philip Watts, Chief Constructor of the Navy, is 456 feet 10 inches long overall, 430 feet between perpendiculars, and 49 feet 10 inches in breadth, and her displacement at load draft is about 5600 tons. She will carry eight 6-inch guns, two broadside torpedo tubes, and will have a storage capacity for seven torpedoes. Protection is afforded to the waterline and the hull above this line by an armor belt extending the whole length of the ship. The thickness of this belt is 2 inches amidships. Further protection of the vital machinery is afforded by the coal bunkers. The inner bottom is continuous throughout the magazine, machinery and shell room spaces, and the hull is divided transversely and longitudinally with water-tight bulkheads.

The vessel will be propelled by steam turbines of the Parsons' type, arranged to drive four shafts, each of the shafts being available for going either ahead or astern. The designed revolutions when the machinery is developing full power will be about 500 per minute. The condensers are of the Uniflux type, and are designed for the high vacua necessary with turbine machinery. The water-tube boilers are of the three-drum small tube type, the tubes being 1⅛-inch and 1⅜-inch diameter. The boilers are primarily intended for burning coal, but special arrangements have been made to enable oil fuel to be burned in conjunction with coal when this is necessary. Many improvements have been made in the machinery as a result of the experience which has been gained in previous vessels of the class. The whole of the steel forgings in connection with the turbine machinery have been manufactured at the shipbuilders' steel works at Sheffield.

The ship is electrically lighted throughout internally by incandescent lamps, and arc lamps for use when coaling have been provided. For coaling purposes two electrically driven coaling winches will be used. They are capable of lifting one ton to a height of 40 feet at speeds varying from 75 feet to 200 feet per minute. The ammunition hoists, the ash hoists, and the after capstan are all electrically driven. The forward capstan placed on forecastle deck can be worked by steam or hand. The officers are berthed aft on the lower deck and on the starboard side of the upper deck. The crew occupy the forward portions of these decks. Ten electrically driven 12½-inch fans will supply air to the magazines, shell rooms, steering compartment, engineers' workshop, and working spaces beneath the lower deck, and also to the cabin and crew spaces, etc. The engine rooms will be closed down for action and ventilated entirely by 20-inch and 25-inch electric fans.

Electrically driven reciprocating pumps with auxiliary hand gear for drawing water from the sea and delivering it to a sanitary tank, also for the distribution of fresh water to the various apartments, are part of the equipment. The steering gear, which is of the screw pattern, is worked by steam or hand, and is controlled from the bridge by telemotor gear. The wireless telegraphy installation is according to the latest Admiralty requirements. There are four searchlights placed in suitable positions and a comprehensive arrangement of voice pipes, telegraphs, and telephones. The ship will be manned by about 400 officers and men.

NEW ZEALAND PRESENTS A BATTLE-CRUISER.—The Admiralty announce that they have recently been in communication with the government of the Dominion of New Zealand upon the employment of the battle-cruiser which is now building at the charge of the Dominion for presentation to the Royal Navy. It had been intended that this vessel should be stationed in the Far East, but the government of New Zealand have, in response to Admiralty inquiries and suggestions, expressed their wish that the Admiralty should employ this vessel wherever her services can be most useful. His Majesty's Government have gratefully accepted this intimation. As the British squadron on the China Station has recently been reinforced by the *Defence*, the Admiralty have decided that the battle-cruiser *New Zealand* can best at present be employed in home waters. She will accordingly, as soon as she is completed, visit the Dominion of New Zealand, probably in the early part of next year, after which she will join the first cruiser squadron in the first fleet, which her arrival will complete to its full strength of five ships.

The Dominion of New Zealand has, by this latest act, set her seal to the Imperial ideal—one Empire, one flag, one fleet. Her decision is of the greatest significance and promise, and the announcement is made at a peculiarly suitable moment. The standard of naval strength of the European naval powers is rapidly rising, and the burden upon the British taxpayer is increasing, and with a devotion which the British people will realize and acknowledge in fitting terms, the smallest of the self-governing

Dominions makes her offering to the common cause—the protection of the interests of all the Britains. It should be added that towards the general expenses of the navy New Zealand is also contributing £100,000 annually. In proportion to her wealth and population she is giving more to the naval defence of the Empire than any section thereof, and by her latest act has set a new and splendid example of devotion to the larger policy—the policy of future generations.—*United Service Gazette.*

H. M. S. *Firedrake*, one of the three special destroyers ordered by the Admiralty last year from Messrs. Yarrow & Co., of Glasgow, had a successful official full-speed trial on Saturday, June 29, on the Skelmorlie deep water measured mile at the mouth of the Clyde, attaining during a continuous run of eight hours a mean speed of 33.17 knots, thus exceeding the contract speed of 32 knots by 1.17 knots.

The vessel is 255 feet long by 25 feet 7 inches beam, and is propelled by Parsons' turbines driving two shafts, steam being supplied by three Yarrow water-tube boilers fitted with the firm's latest feed-heating devices.

Superheating, which has been introduced throughout stationary engines and to a large extent in locomotive practice, owing to the success of the *Archer* and *Attack*, will undoubtedly become universal in marine practice, as there is an undoubted gain of 10 per cent. By superheating, the condensation of the steam in its passage through the turbine is materially reduced, and when cruising entirely avoidable.

A MINE-LAYING SQUADRON.—Every credit should be given to the authorities for the way many of the *Naiad* and *Apollo* class of second-class cruisers have been rescued from those stepping stones to the scrap heap, the Mother Bank and outpost moorings—and fitted up for a further period of service with the fleet as mine layers. It has taken some time to complete an efficient squadron of mine layers in this way, but the British Navy now possesses such a squadron, and one which has no equal in the world. These ships are under the command of specialists, and are frequently exercised at the sort of work they would be called upon to perform in time of war; while they have recently completed a program which was a searching test of their efficiency for these functions. The test was got through successfully and with credit to all concerned. The vessels have been fitted up at the Royal dockyards as secretly as is possible in these days of many spies and informers, and it is believed that the Admiralty have succeeded in keeping essential knowledge of their equipment from those who are anxious to discover it; it is certain from the facility with which long lines of blockading mines are run that the plan adopted for dropping them is quite reliable. In fairly shallow water, when blockading an enemy's ports or defending our own, such a squadron of mine layers will be of the utmost utility to an admiral, especially when manned by crews who have become experts by constant practice in handling them and the intricate machinery with which the mines are well and truly sown along the exact channel it is intended they should be dropped.—*United Service Gazette.*

SUBMARINES.—Submarine *A3* was towed into West Bay, and when some miles off Portland she was fired at by the battleship *St. Vincent*, which, at a range of 200 yards, struck her with the third shot and sent her to the bottom.

Submarine *E5* was launched from Messrs. Vickers' works at Barrow recently. She is of the latest type, and will be fitted with disappearing quick-firing guns and wireless telegraphy apparatus.

The lifting powers of the new floating dock for destroyers at Harwich are to be tested by the docking of the *Ghurka* and *Mohawk*, whose united displacement is 1735 tons. The dock was designed to lift 2000 tons.—*Army and Navy Gazette.*

COALING.—At Portland on May 13 the *average* coaling of the two first squadrons of battleships was 301 tons per hour. These squadrons comprise the 13 *Dreadnoughts* and two *Lord Nelsons.—Le Yacht.*

THE ADDITION TO THE NAVY ESTIMATES.—Mr. Winston Churchill once more gave proof of the determination which he has consistently shown to maintain our supremacy on the principle that it is easiest to ensure peace by being thoroughly prepared for war. When the Navy Estimates of the year were issued, it was stated that they had been framed "on the assumption that the existing programs of other naval powers would not be increased," and that "in the event of any such increases it will be necessary to present supplementary estimates both for men and money." Germany is adding to the provisions of her naval law the amending bill providing for the construction of three additional battleships during the next three years, as well as for the laying down of more small cruisers and submarines; at the same time, in order to add to the number of ships continuously in commission in the North Sea, 15,000 officers and men are to be added to the personnel. The bill providing for these additions only passed its second reading in the Reichstag on a Tuesday evening. Mr. Winston Churchill, in the House of Commons, on Wednesday, announced that he would present supplementary estimates to provide for the increase promised in view of such contingency as has now arisen by the action of the German naval authorities. No information, of course, is yet available as to the extent of the increase decided upon by the First Lord of the Admiralty; but it may be remembered that in introducing the estimates in March, Mr. Winston Churchill stated that the standard of naval strength aimed at by the British Admiralty was a standard of 60 per cent in excess of the then existing German naval law, so that during the next six years from now we should lay down per annum four ships and three ships alternately, beginning with four this year; this, he stated, "is the least that will maintain the 60 per cent standard." He made it clear, however, that any single additional ship added, say, by Germany, would be met by two additional ships laid down by Britain. As Germany has decided to lay down three additional ships during the next three years, obviously the British Admiralty must lay down six ships during the same period. Consequently the program of the next three years ought to be not four, three, and four ships, but six, five and six ships in the respective years. At the same time, additions must be made to the personnel. It is needless to say that the country has shown ready an almost universal approval of the First Lord's statement. The effect of this announcement was augmented by a speech at the dinner of the Worshipful Company of Shipwrights, when he stated that "although the additional estimates will not be so large as some would hope and others would fear," His Majesty's Government would be able to convince the House of Commons that what they asked for was both necessary and sufficient. He expressed the widely entertained satisfaction that, while we have several parties in the state, we have only one navy, which is the care of all parties. Another point in his statesmanlike speech was the announcement that the Third Sea Lord, who is the officer of the Admiralty charged with the care of the great province of matériel, would be relieved of all unnecessary departmental work, so that he might have leisure for reflection and for study, and freedom to move about frequently in the sea-going fleets. This idea of closer contact between the executive officers of the Admiralty and the fleet is further ensured by the unusual procedure now decided upon, that Vice-Admiral Prince Louis of Battenberg, one of the Lords Commissioners, will command a fleet during the maneuvers, which are to be carried out on an exceptionally large scale towards the end of July. Brief reference should also be made here to the development in naval policy which was enunciated by Mr. Winston Churchill, whereby the fleet would be concentrated more in home waters. As a consequence of the restriction in world-wide mobility involved by this, the plea was put forward that sooner

rather than later, naval responsibility must be shared by the colonists, to this extent: that while the mother country maintained the Empire's sea supremacy in the decisive theater of European waters, the daughter states might undertake the control and guarding of the rest of the Empire.—*Engineering.*

The Admiralty announce a further important step in connection with the new organization of the fleet, which was explained by the First Lord in his speech introducing the Navy Estimates. The changes will be effected in the course of the next month, and when they are completed, six battle squadrons will be homogeneous. The first and second will consist of the *Dreadnoughts* and the *Lord Nelsons.* The third squadron (ex-Atlantic) will be newly formed of the eight *King Edward VII* class. In the course of the summer the present Mediterranean battle squadron will be based on Gibraltar and formed into the fourth battle squadron, and consist at the outset of the *Duncan* class. All these four squadrons will be in full commission and will form the first fleet. The fifth battle squadron, hitherto known as the third division (nucleus crew ships), will consist of the eight ships of the *Formidable* class. The seventh battle squadron (third fleet) will comprise eight *Majestics,* and it is to this squadron that the new immediate reserve will be attached. The two battleships of the *Swiftsure* class, now in the Mediterranean, will pass into the third fleet. It will not be necessary to complete the sixth or to form the eighth squadron at present. It is intended that the first, second, third, fourth, fifth, and seventh squadrons should take part in the maneuvers in July as regular tactical units.—*United Service Gazette,* May 9.

The Admiralty have decided upon the construction of a third graving dock at Rosyth naval base, at a cost of £250,000. This additional dock, which will be 900 feet long, will occupy the most easterly position of the three, and will adjoin the submarine basin of the two docks already under construction. One has been excavated to the required depth, and is being bottomed with 25 feet of concrete; the excavation of the other is also well forward. According to the revised plans of the Admiralty, sufficient land will be reserved to permit of the construction of a fourth graving dock if necessary. The submarine basin, which was almost completed, is being further deepened to the extent of 5 feet to provide the additional accommodation necessitated by the Admiralty's revised scheme. The proposed site of the administrative offices has also been removed further inland. The foreshore towards the western extremity of the base, and extending for nearly a mile, will be reclaimed and raised to provide sites for an extensive range of workshops.—*United Service Gazette,* May 9.

THE ADMIRALTY 32,000-TON FLOATING DOCK.—There has just been delivered to the Admiralty, for use in the Medway, a floating dock capable of lifting 32,000 tons, and therefore suitable for accommodating the largest of our battleships or battle-cruisers. The dock has been constructed at the Wallsend shipyard of Messrs. Swan, Hunter & Wigham Richardson, who have executed orders for similar docks for the British Admiralty, the governments of Natal, Southern Nigeria, Japan, and Spain, and also for numerous foreign clients in various parts of the world. During this year the same builders have delivered to the British Admiralty three floating docks: one for raising submarines, another for torpedo-boat destroyers, and this battleship dock, the latest and largest yet constructed in the United Kingdom.

The designs of the dock were prepared in conjunction with Messrs. Clark & Standfield, of Westminster, who have a world-wide reputation for such work. It is of the so-called "box" type, with two side walls—that is to say, on each side of the pontoon proper, and running almost the full length of it, there is erected a hollow wall. Not only are these side walls permanently attached to the pontoon, but the dock cannot be divided

into parts longitudinally without the side walls of each part remaining attached to the bottom. This constitutes broadly the difference between the "box-dock" and docks of the "self-docking" type. The latter are built in detachable sections, so that one or more portions of the dock can raise the remainder for purposes of cleaning, painting, and repairing.

Some idea of the great size of the Medway dock may be gained when it it is known that it covers an area of 2¼ acres. The over-all dimensions are 680 feet long and 144 feet wide. The clear width between the rubbing timbers at the top deck is 113 feet. The side walls are 66 feet high on the outside of the dock and rise 46½ feet above the pontoon. In length they are 520 feet along the pontoon deck and 440 feet at the top. The depth of the pontoon is about 20 feet. The weight of steel plates and angles worked into the dock is about 12,000 tons. The dock is designed to lift battleships of displacements up to 32,000 tons, with drafts up to 36 feet. The keel-blocks, of English oak, are spread over a length of 640 feet, and the two lines of bilge-blocks at each side cover a length of 280 feet.

The two forward chimneys are hinged, so that they may be turned down to allow the travelling crane to pass to the forward end of the wall. Landing stages are provided on each side of the dock with stairways leading to the tops of the wall, so that the dock can be boarded at any time, no matter how far it may be submerged.

The gangways are swung on pivots, and, when closed, give access from one wall to the other. At each end of each wall there is a very strong timber roller fender to help to guide vessels when being docked. The mooring attachments have been made exceptionally large and strong, so as efficiently to hold the dock in a tideway.

Each of the side walls has a water-tight deck running the whole length, and the bottom pontoon is divided both transversely and longitudinally by a number of water-tight bulkheads. These bulkheads and decks divide the pontoon and walls into about eighty water-tight compartments. These are grouped into sections, each of which has its own set of valves, so that it can be flooded or emptied independently. There is a complete service of telepones to connect the various machinery spaces with the principal control station in the valve house, which is placed on the starboard wall at its forward end. From this station are controlled all the valves and pumping arrangements for the various compartments of the dock. A number of pressure gauges show the height of water in each compartment. The gear for operating the valves is on the Westinghouse electro-pneumatic system.

The steam power is supplied from eight boilers of marine type, working at a pressure of 155 pounds per square inch, constructed at the Neptune works of Messrs. Swan, Hunter & Wigham Richardson, Limited. Two of these boilers are placed at each end of each wall. The pumping machinery, supplies by Messrs. Gwynnes, Ltd., of Hammersmith, includes eight compound condensing engines. Each drives a set of centrifugal pumps. For wash-down and fire services two direct-acting steam pumps have been placed in each wall, capable of delivering 400 gallons of water per minute. A dynamo room is provided in each wall, the installation of machinery comprising duplicate sets of Messrs. Browett, Lindley & Co.'s two-crank compound high-speed engines, running with forced lubrication, and driving Westinghouse direct-current generators. This equipment of electrical machinery supplies current for driving the machinery in the workshops, the travelling cranes, the valve gear, and for lighting, etc.; through flexible conductors, power and light are also supplied to any warship that may be in the dock. In each wall of the dock there has also been placed an air compressor providing power for a complete equipment of pneumatic tools, and also for actuating the electro-pneumatic valve-opening gear.

In the starboard wall there is a fine range of workshops. These include a coppersmith's shop, 27 feet long, and three other shops, each 50 feet long—namely, a lathe shop, a smithy, and a machine shop. These workshops are remarkably well equipped, and contain a number of fine tools, such as high-speed lathes, boring and milling machines, an electro-pneu-

matic power hammer, a flanging machine, punching and shearing machines, forges, an hydraulic pipe-bending machine and planing machines. In the port wall living accommodation, including mess rooms, lavatories, etc., has been provided for the dockmaster, petty officers, and dock crew. On the top of each wall there is a 5-ton electric crane, constructed by Messrs. Booth, of Rodley. These cranes have separate motions for travelling, revolving, derricking, hoisting and lowering. Eight powerful steam-driven capstans, supplied by Messrs. Harfield, are placed on the walls for warping ships into position.

The dock was towed from the Wallsend shipyard to the Medway by four powerful tugs owned by Messrs. L. Smith & Co., of Rotterdam. The voyage was safely accomplished, and the dock is now ready to undergo the lifting trials in the presence of the Admiralty officials. It will not be possible to provide a battleship with a displacement of 32,000 tons, but it is hoped that the Admiralty will test the dock with the largest vessel they possess.—*Engineering.*

This dock was tested July 10, 1912 in Saltpan Reach under officials from Chatham dockyard. Was successful. The battleship *St. Vincent* will be the first vessel to be docked.

THE NAVAL FLYING WING.—The first appointments of naval officers to the newly organized Royal Flying Corps conform to general expectations, and on the whole will be approved by the service. Captain Godfrey M. Paine's appointment as commandant of the Central Flying School on Salisbury Plain will be especially popular. It it a distinction for a naval officer to be the first occupant of this post, the work of which will be of a military as well as a naval character. At the Central School, the preliminary training of pilots will be carried out, three courses of about four months each being held every year for this purpose. The number of flyers at present estimated for naval requirements is forty per annum; not more than one-fourth of this number have as yet passed through the course at the Royal Aero Club's ground at Eastchurch, which is being utilized until the Central School is ready, but the further appointments for training there show that the Admiralty will have no difficulty in reaching the figure specified in the Memorandum on Aviation recently issued. Captain G. M. Paine is not only a progressive officer, but he has been associated with the development of the Eastchurch School since August last, and has qualified for an aerial pilot's certificate by a flight on the Short biplane No. 38. Simultaneously with his appointment to Salisbury Plain, Commander Charles R. Samson is to be commandant of the Naval Wing of the Royal Flying Corps. He will, of course, be stationed at Eastchurch, where the more advanced and special training of the naval pilots will be carried out, and hydroplaning, with boat flying, will be taught. Commander Samson's rise in the new branch has been both notable and rapid, but his success has been achieved by making the most of the opportunities that have come to him and by the daring and skill which have characterized his work. The good wishes of the navy will be with Captain Paine and Commander Samson on taking up their new appointments, and it may confidently be expected that progress in the near future may be even more marked than of late.—*Army and Navy Gazette.*

REQUIREMENTS AS TO SPECIALIZATION IN ENGINEERING.—It has been decided as a temporary measure to suspend the regulation as to the length of service necessary to render naval officers eligible to specialize in engineering. As the first course to qualify for specialization will commence in October, 1913, and at that date there will not be a sufficient number of lieutenants eligible by service, officers desirous of qualifying in engineering will for the present be considered for selection, provided they have performed their six months training in the engine room and have obtained their deck watch-keeping certificate. Lieutenants and sub-lieutenants who entered as naval cadets in September, 1903, and January, 1904, are now permitted to send

in their applications to specialize in engineering with a view to a selection being made for the first course.—*Engineer.*

King George reviewed the battle fleet the second week in May at Portland. The ships were handled in shifting fog and thick weather. The targets were much obscured, but the practice firing, particularly that of the *Orion's* 13.5-inch guns, was excellent. Six submarines attacked the *Neptune* and *Hercules* at sea. The periscopes were but ill-defined splashes in the sea and fog. The *Neptune* was hit twice, once from a bow tube and the other from a stern tube after passing under the battleship. The boats were within 300 yards of the ships when discovered by them. Four aviators located the King's yacht in the thick fog. They used hydro-aeroplanes and found that submarines under water could be seen quite readily.

Submarine *D-4* took the King on a two-mile submerged run outside of Portland harbor.

INCIDENT ON THE "THUNDERER."—*Thunderer* (battleship, Capt. H. Oliver, M. V. O.).—Replying to Mr. Falle in the House of Commons, Mr. Macnamara said:

"I am glad to have this opportunity of giving an emphatic contradiction to the alarmist reports that have appeared in the press, and constitute a gross slander upon the conduct and bearing of the personnel of the Royal Navy. I will read to the House the official account of the accident that has been forwarded to the Admiralty by the commander-in-chief, Devonport:

"'The last shell, except one, was being lowered to "Y" shell room in the service-pattern sling, the point of the shell being upwards. It was about half-way down when owing to a kink in the wire whip a turn came off the drum of the electric winch, and the projectile took charge and fell to the deck of the shell room. It struck an iron ladder on the way down, damaging the rungs and knocking off the cap of the fuse. The shell had been fused on the upper deck. It was immediately hoisted up again and the fuse examined by the lieutenant (G.) and found correct, a cap was put on and the shell returned to its bay, where it now is quite serviceable. No one was hurt, and the ladder will be repaired by the ship's staff. The work of taking in ammunition was not stopped, no one left his station, and there was no consternation.'

"I may add that the fuse is a percussion fuse and was fully protected for transport by means of a cap as well as by its own safety arrangements."—*Army and Navy Gazette.*

STRATEGICAL ARRANGEMENT OF THE BRITISH FLEET.—The policy of naval economy instigated in 1906 by the economists, and maintained for some two years or more, deprived the fleet of considerable cruiser force, thus weakening what has been known for many decades as our Empire patrolling; this policy has made it possible for critics of our present fleet organization to assert that we have abandoned our Empire defence, a statement which, although it has a coloring derived from the foregoing facts, is not quite true in substance. It would, indeed, be ridiculous to take much notice of it were it not calculated to mislead the oversea Dominions, who, after years of naval support and protection by the mother country, are having the fact brought home to them that the task of Empire patrol is now one that cannot easily be borne by the motherland in its entirety. The factors that have brought about this situation are numerous, but the salient ones, briefly dealt with, are: (1) The increase of contemporary naval power adjacent to the heart of the Empire, which necessitates a corresponding increase in our home fleets; (2) the policy of weakening instead of strengthening our cruiser power on the Empire trade routes, which, it may be remarked, is not the fault or neglect of the present War Minister or Sea Lords; (3) the neglect shown hitherto in coming to a decision or agreement with the merchant marine on the question of arming mercantile craft should war be imminent or active. All these matters are, we believe, being remedied

as quickly as such a colossal task can be attended to in all its details, but during the evolutionary stage some safeguard was absolutely necessary, and the concentration of our naval power, under the present organization, is the plan adopted. It represents neither the abandonment of Empire patrol or guardianship, but is simply a precaution taken during the period that errors of the past decade are being corrected, and we feel certain that the observant populace of our far-flung Dominions will realize that such a course was necessary.

Mr. Balfour says: "There are two ways in which a hostile country can be crushed. It can be conquered or it can be starved. If Germany were masters in our home waters she could apply both methods to Great Britain. Were Britain ten times master in the North Sea she could apply neither method to Germany. Without a superior fleet Britain would no longer count as a power. Without any fleet at all Germany would remain the greatest power in Europe." Out of these few sentences British statesmen should be able to clearly discern which way our safety lies.

The most absorbing topic of the situation is that which presents itself in the Mediterranean. Unless we were to consider the possibility of great European coalition, such as Germany, Italy and Austria-Hungary, arrayed in war against us at the same time, there seemed no need to keep bottled up in the Mediterranean a strong and useful battle fleet, when by holding the wayside fortresses and both entrances to the middle sea we could just as effectively maintain command of our eastern routes. The conference, which has just been concluded at Malta between Lord Kitchener, Mr. Asquith and the First Lord of the Admiralty, was but another step towards the consummation of this strategy. The Egyptian garrisons will probably be strengthened, the wayside garrisons in the Mediterranean made siege proof, and the sea power, thus released for a time, utilized along the more open routes, or if necessary to cover the heart of the Empire. Australia, India, South Africa and Egypt will in course of time join hands, which they can safely do as long as the Japanese alliance holds good, whilst with the opening of the Panama Canal and the completion of the Cape to Cairo Railway, which are larger factors in Empire consolidation, the present disposition of not only the fleet, but also much of British land power seems to be proceeding on sound lines. There is, however, a paucity in our sea power at the present time which makes careful strategy necessary.—*United Service Gazette.*

THE ENGLISH NAVAL MANEUVERS.—These were held in July and were preceded by a review of the fleet at Spithead on July 9. The members of the Houses of Lords and Commons inspected the fleet and saw two flights by naval hydro-aeroplanes, destroyer and submarine attacks, and the getting under way of the fleet. There were six lines of vessels, a summary by classes of which follows:

Battleships	42
Battle-cruisers	5
Armored cruisers*	26
Protected cruisers	9
Flotilla cruisers	12
Depot ships for destroyers and submarines	9
Mine layers	6
Mine sweepers (torpedo gunboats)	3
Destroyers	107
Submarines	19
Hospital ship	1
Total	239

*Including the light battleships, *Triumph* and *Swiftsure*, which will be employed as cruisers during the maneuvers.

The *Thunderer* flew the flag of Prince Louis of Battenburg, the commander-in-chief of the combined fleets, and also in command of the Blue fleet for the maneuvers. This fleet had nearly twice the strength of the Red fleet under Sir George A. Callaghan with the *Neptune* as flagship. The number of flag officers afloat on this occasion is noteworthy. There were a total of twenty, including in the list five vice-admirals and fifteen rear-admirals. The maneuvers hoped to give as an object lesson that the nation must see the necessity of maintaining above all else the supremacy of the North Sea, the command of the Mediterranean being distinctly secondary to that.

At 5 p. m. the signal was made for the fleet to weigh, and precisely to the moment the long line of cruisers began to move away to the eastward. In ordered precision, led by the huge battle-cruiser *Lion*, each ship maintaining her distance from the one ahead of her, at a speed of eight to ten knots, the first, second and third cruiser squadrons passed away up Channel and out of sight. Two more divisions of cruisers followed in single file, and then came the battleships in two columns of divisions in line ahead.

The maneuvers began at midnight July 12. The Red fleet, the attacking fleet, had as its main object that of landing troops on the northeast coast of Scotland, and to capture or blockade all the shipping ports on the east coast.

A party of 400 Royal Marine Light Infantry and 200 Royal Marine Artillery proceeded from Portsmouth by steamer to the Orkney Islands, to take up a defensive position and prevent any attempt to land.

Milford Haven was defended by four cruisers and two mine layers from the Blue fleet, the forts being manned by artillery.

Sir William H. May on the *Euryalus* was chief umpire.

Few details are available as to the actual work of the fleets. Several minor accidents, such as collisions between destroyers, the grounding of a submarine on the Pentlands Shoals, took place, but no lives were lost.

A landing from the Red fleet did take place at Filey. The numbers landed were so few, before the defenders came upon the scene, that they must certainly have been taken prisoners in actual warfare.—*Army and Navy Gazette.*

The battle-cruiser *Lion* distinguished herself by coming on the scene early and holding the raiders in check until her slower consorts came to her assistance. This landing was not a success. The torpedo craft played a very prominent part in the operations. A small part of the Red fleet escaped into the Atlantic by the north, which furnishes an argument for the basing of a battleship squadron at Gibraltar, and cruiser squadrons at Queenstown and Pembroke for the protection of the many steamer lines converging on these points.

ITALY.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Dante Alighieri	19,000	23	12 12-in., 16 3-in.	Castellamare	Commissioned
Cavour	22,000	22	13 12-in., 14 3-in.	Spezia	Launched Aug. 10, 1911
Giulio Cesare	22,000	22	same	Ansaldo-Armstrong	" Oct. 15, 1911
Leonardo da Vinci	22,000	22	same	Genoa (Odero).	" Oct. 14, 1911
Andrea Doria	25,000	23	13 12-in., 14 5.9-in.	Spezia	Laid down Mar. 24, 1912
Duilio	25,000	23	same	Castellamare	" " Apr. 30, 1912
Dandolo	28,000	25	10 14.2-in.	....	Projected
Morosini	28,000	25	same	....	"

PROGRESS OF VESSELS.—The *Dante Alighieri* has gone into service after completing some successful trials. The *Conte di Cavour*, the *Giulio Cesare*, and the *Leonardo da Vinci* will join one or other of the Italian squadrons in July, 1913. The *Andrea Doria* and the *Duilio* will not be ready for service until July, 1915. The Italian Admiralty will shortly commence the construction of two ironclads, which are to have a displacement of 28,000 tons, and which are to steam at the rate of 25 knots. They will have four turrets, two forward and two aft, so as to have five guns available when chasing, and a similar number when retreating. The new ironclads are to be ready for service by July, 1916.—*Engineering.*

TRIALS OF "DANTE ALIGHIERI."—These were satisfactory. In seven days only the battleship put to sea three times for maximum speed and endurance trials. She developed 16,500 and 26,000 horse-power. On her return to Spezzia she steamed at 24 knots (according to *Moniteur de la Flotte*) and her turbines of the Parsons' type worked perfectly without strain on the personnel or any of the usual mishaps on trial trips.

The *Dreadnoughts Nos. 7* and *8* will probably be named *Dandolo* and *Morosini*. They will have from 26,000 to 29,000 tons displacement, have ten 14.2-inch guns, and a maximum speed of 25 knots. The cost is estimated at $18,000,000 each.

The torpedo-boat *OS13* of 120 tons made over 30 knots on her trials with 3200 I. H. P. The armament of the boats of this type consists of two torpedo tubes amidships and two 7.6-cm. guns.

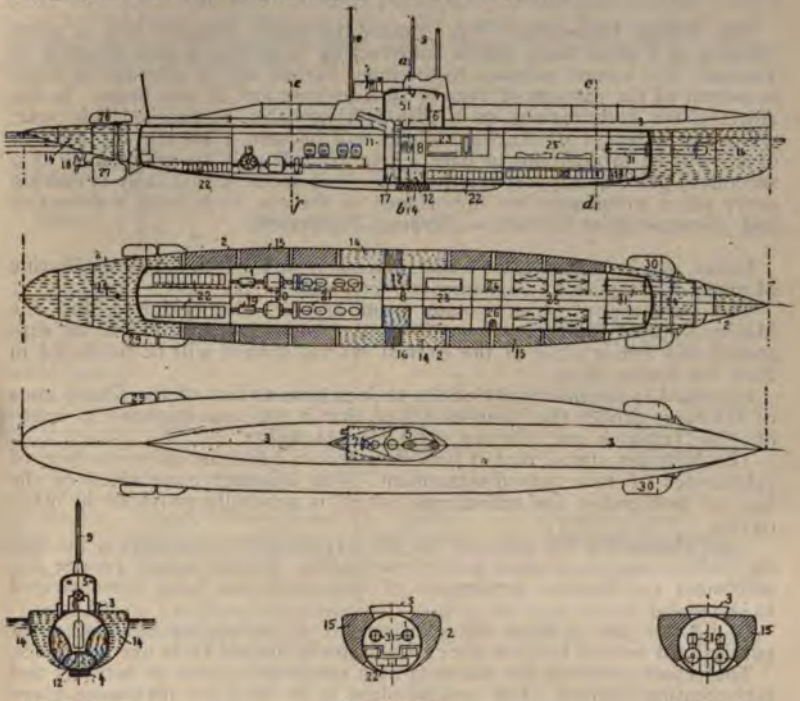
As a result of the war Italy is determined to increase her navy. Parliament appropriated a supplementary law to that of the 1912-13 budget, giving 15 million lire for building larger torpedo vessels and 6.5 million lire to increase the personnel of men from 31,000 to 33,000, and providing for additional supplies of coal and ammunition and for radio stations and aviation apparatus.—*Marine Rundschau*, by W. H. B.

ENDURANCE TEST OF SUBMARINE.—June 14 and 15 the submarine *Glauco* was submerged for a period of 22 hours with full crew on board to test the endurance of the personnel when so long submerged. The naval surgeon who conducted this test reported that the crew sustained no injury and that their health had not been impaired by having been submerged in the submarine for that long period of time. Similar tests are to be made with other Italian submarines. The submarine *Foça* will make a 12-hour submerged cruise in the Adriatic.—*Marine Rundschau*, by W. H. B.

DISEMBARKATION OF THE ITALIANS AT DERNA.—The rafts or iron pontoons practically used were 19 feet 6 inches long by 9 feet 9 inches wide and 3 feet high carrying 38 to 40 men, or from 8 to 10 horses each. Joined together in pairs, by means of locking bolts previously fitted, they can take 90 to 95 men, or 20 to 24 horses each pair. Four of these rafts were carried —two forward and two aft, supported on iron crutches—on each of the Italian troop transports. It was found that they could be lowered into the water and locked together in pairs in four or five minutes in calm weather. —*Journal of the Royal United Service Institution.*

THE ITALIAN SUBMERSIBLES.—In the Italian naval construction program for 1910-11 provision was made for building a flotilla of submarines, the units of which were to be of a variety of types, in order to test the relative merits of different designs. Two of these vessels, the *Galileo Ferraris* and the *Giacinto Pullino*, are of the *Cavallini* type, and are nearing completion at Spezzia. They have a displacement of 400 tons, a speed of 18 knots above water and a speed of 14 knots when running submerged. Two other boats, the *Nautilus* and the *Nereide*, are being built

at Venice, and are of the *Bernandis* design, while eight units, the *Argo, Fisalia, Medusa, Salpa, Velella, Yalea, Yantina,* and *Zoea* are being constructed by the Fiat Company. The latter eight vessels are very similar in type to the Laurenti submarine *Foça*, except that they are somewhat larger. Their displacement is 250 tons at the surface and 300 tons when submerged, and their corresponding speeds 13 and 8½ knots.



SECTION A–B. SECTION C–D. SECTION E–F.

1. Inside or water-tight hull.
2. Outside hull.
3. Surface navigation platform.
4. Detachable safety weight.
5. Conning tower.
6. Steering gear for submarine navigation.
7. Steering gear for surface navigation.
8. Diving rudders control.
9. Periscopes.
10. Signal mast.
11. Torpedo passage.
12. Water ballast for inside hull.
13. Trimming tanks.
14. Water ballast for outside hull.
15. Oil fuel tanks.
16. Lubricating oil tanks.
17. Fresh water tanks.
18. Reversible propellers.
19. Propeller reversing gear.
20. Electric motors.
21. Diesel engines.
22. Storage batteries.
23. Officers' quarters.
24. Galley.
25. Crew's quarters.
26. Closet.
27. Lower vertical rudder.
28. Upper vertical rudder.
29. After diving rudders.
30. Forward diving rudders.
31. Torpedo tubes.

THE ITALIAN SUBMERSIBLE "ATROPO."

—From *Engineering.*

The thirteenth and last vessel of the new flotilla was built by Messrs. Krupp and was launched at Kiel in the end of March. This boat, the *Atropo*, is illustrated in the accompanying engraving. She has a length between perpendiculars of 146 feet and a moulded breadth of 14 feet 6 inches, her under-water displacement being 320 tons. On the surface her speed is 12½ knots, and in this condition propulsion is secured by 2 two-cycle Diesel engines of 350 horse-power each. When running submerged she

employs two electric motors of 200 horse-power each, and attains a speed of 8 knots. The radius of action is 1300 miles above water and 40 miles submerged.

Heavy oil Diesel engines are being used in all the vessels of this flotilla, that of the *Atropo* being of the Germania design, and that of the others either M. A. N. or Fiat productions.—*Engineering.*

The Italian Government has decided to make Taranto into a great fortress and naval base, and is constructing there the largest drydock in Europe. The second entrance to the inner harbor will be enlarged in order to permit of the passage of vessels 650 feet long and 88 feet beam. In the Adriatic the fortifications at Venice will probably be finished this year, while the defences of Ancona, which will become a station for torpedo craft, will be brought up to date. Brindisi will only be maintained as a secondary point of support for the fleet. It is declared that Italy is making every effort to enhance her importance on the sea, both from a defensive and offensive point of view.—*Shipping*, Illustrated.

NOTES ON ITALIAN NAVY.—The official report of the Italian Marine Ministry has replies to Parliamentary criticism of the navy.

The purchase of armor plate from abroad was criticized and the Ministry stated that from henceforth the home industry would be supported and armor plate of the French Marrel system will be produced in Italy for Italian Navy.

In regard to the inferiority of the 12-inch guns to that of the Krupp guns of the same caliber the Minister stated that it was contemplated to introduce the 14.2-inch guns for the super-*Dreadnoughts*.

The Minister stated that it was intended to build an offensive type of submarines of 1000 tons displacement. The Minister complained of the lack of mothership for submarines which is generally provided in other navies.

Notwithstanding the efficiency of the torpedo destroyers during the war the Italians are not satisfied with these vessels. Greater speed, greater displacement and heavier armaments of destroyers has been demonstrated to be needed.

It did not pay to incur the expense for torpedo-boats designated for purely local service because their displacement limited their use in service.

The report promises the adoption of a combined system of turbines and reciprocating engines. The turbine plant to be used for maximum speed and the reciprocating engines for economical cruising.

The report states that efforts will be made to reduce the building period required for battleships and demands the construction of peculiar vessels for the transportation of oil fuel. A revenue marine is also recommended to prevent smuggling.

The war has demonstrated that the Italian merchant marine is not in a satisfactory condition. There is but little hope of any marked improvement in this respect.

In 1911 there were 49 steamers that made their first voyages under the Italian flag. Of these only 8 were built in Italian shipyards, viz.: One cargo boat of 5600 tons, six steamers of 4000-1650 tons, and a small ship of 500 tons.

Italian merchant marine has not made proper progress, and conditions appear to grow worse.

These conditions followed notwithstanding the fact that in 1911 steamship companies throughout the world did a profitable business. The Hamburg-American Line made a dividend of 9 per cent and other companies as high as 12 and 15 per cent.

Two measures are advocated as necessary to revive Italian merchant marine.

1. Support by credit in the naval budget that capital may be invested in the merchant marine with greater security.

2. To provide that all the coal to be used by the Italian Navy shall be carried exclusively by vessels flying the Italian flag. Nine million tons of coal are annually required for the Italian Navy and the freight on this would stimulate that Italian shipping.

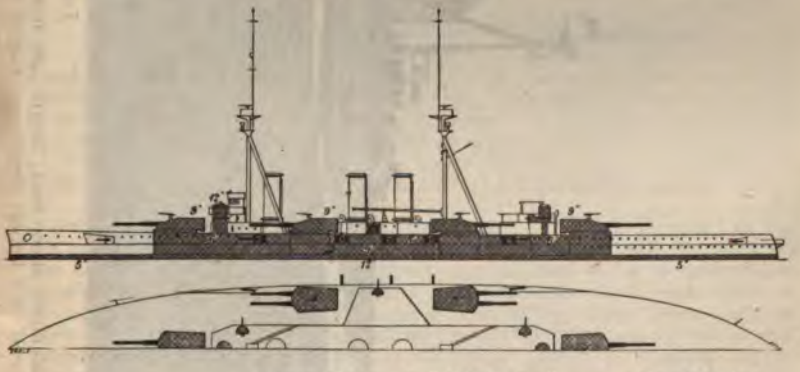
In regard to the strength of the Italian Navy personnel the report states that December 31, 1911, there were a total of 35,753 of which 5830 were called out for the war mobilization, leaving 29,923 in active service of whom 21,305 served afloat and 8618 on land. The number of the mobilized men called out for war serving afloat was 4281.—*Mitthcilungen aus dem Gebiete des Seewesens,* by W. H. B.

JAPAN.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Settsu	20,800	20.5	12 12-in., 10 6-in.	Kure	Completing for sea
Fuso	30,000	22	12 15-in., (?)	"	Laid down March, 1912
Battle-Cruisers					
Kongo	27,500	27	8 14-in., 16 6-in.	Vickers	Launched May 18, 1912
Hiyei	27,500	27	same	Yokosuka	Keel laid Nov. 4, 1911
Haruna	27,500	27	same	Kobe	" " Mar. 16, 1912
Kirishima	27,500	27	same	Nagasaki	" " Mar. 17, 1912
Protected Cruisers					
Shikuma	5,000	26	6 6-in., 4 3-in.	Sasebo	Completed trials
Yahagi	5,000	26	same	Nagasaki	Launched Oct. 3, 1911
Hirado	5,000	26	same	Kobe	" June 29, 1911

The *Kawachi* has been commissioned. She is the first all big-gun battleship to be completed for the Japanese Navy. She has three funnels instead



ARMOR PLAN OF "KAWACHI." —*Engineering.*

of two as shown in No. 142. Her protection consists of a main waterline belt of 12 inches thick amidships, tapering to 5 inches at the ends. Above this is 9-inch armor along the lower side of the gun-deck, and above

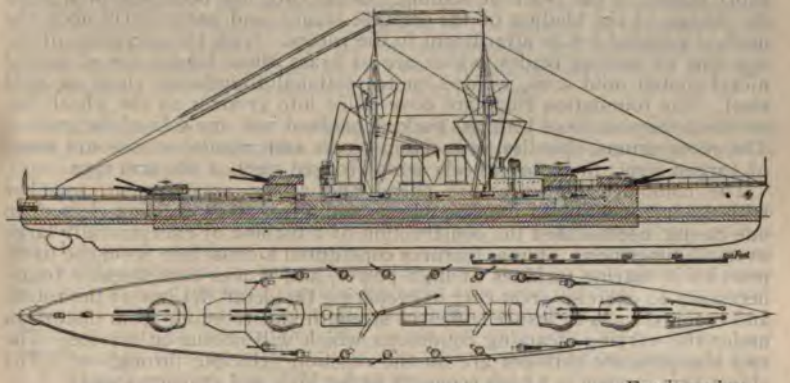
JAPANESE BATTLESHIP "KAWACHI."

Displacement, 21,000 tons; length, 480 feet; beam, 83.9 feet; draft, 26.9 feet; Curtis turbines of 25,000 horse-power; speed, 20.5 knots; armament, twelve 12.2-inch 50-caliber guns in 6 double turrets, ten 6.08-inch 50-caliber guns, eight 4.8-inch 50-caliber guns, eight 3.04-inch guns, four machine guns, five 18-inch under-water torpedo tubes.

this is 6 to 8 inches of armor behind which are the 6-inch guns. The heavy gun turrets are 9 inches, and there is a 2½-inch protective deck. Motive power consists of Curtis turbines driving three shafts, the boilers being of the Mayabara type. Horse-power is 25,000, and coal supply is 2500 tons.

The *Kawachi* was laid down at Yokosuka on April 1, 1909.

THE "KONGO."—This, the first of four battle-cruisers, was launched May 18, 1912, at Vickers' works at Barrow-in-Furness. The other three vessels are building in Japan. They are noteworthy as being the first battle-cruisers to carry 14-inch guns, an increase in size over the guns of the *Lion*. The dimensions are: Length, 704 feet; beam, 92 feet; draft, 27.5 feet; displacement 27,500 tons; speed, 28 knots; maximum coal, 4000 tons; oil, 1000 tons; to be driven by Curtis turbines with horse-power between sixty and seventy thousand; armament, eight 14-inch guns on center line, sixteen 6-inch, 16 smaller guns, and many submerged topedo tubes. The 6-inch are on the upper deck level giving them a wide arc of fire. Armor protection is good, being carried to the height of the boat-deck, the main belt, 10 inches thick, extends well below the water-line and below that is an auxiliary armor belt. There is a special arrangement of armored bulk-



—*Engineering.*

ARMOR PLAN JAPANESE BATTLE-CRUISER "KONGO."

heads protecting the vital parts of the ship, the magazines being completely surrounded with special steel armor. An armored deck is fitted at water-line level, and, in addition to this, there is an armored deck enclosing the ship from stem to stern at the level of the top of the side armor.

There are 36 Yarrow water-tube boilers of the large tube pattern in eight separate compartments on each side of a longitudinal bulkhead.

DETAILS OF THE MACHINERY PLANT OF THE JAPANESE BATTLE-CRUISER "KONGO."—The water-tube boilers burn oil fuel as well as coal; the turbines are of the combined impulse and reaction type; and in the details and in auxiliary engines several interesting improvements have been effected. To ensure safety, the boilers are arranged in eight compartments, four on each side of a center-line bulkhead, which extends throughout their whole length, while the coal bunkers are also disposed to afford protection. Again, the engines—two sets of turbines on four shafts—are arranged in two compartments, with a center-line bulkhead between them. The condensers, four in number, are placed aft of the turbines in two separate rooms, together with centrifugal pumps and other auxiliaries. The whole of the arrangements, including those of the steam and exhaust piping, feed, drain, and oil lubrication systems, are such as to preserve the independence of the

port and starboard sets of machinery, and allow either set to be worked when all parts of the other are disabled. Thus steam can be got from any of the eight boiler rooms. Each set of turbines consists of one high-pressure and one low-pressure turbine, the former being coupled to the outer, and the latter to the inner, line of shafting on each side of the center line. Both the high and low-pressure astern turbines are incorporated in the after end of the same casings as the corresponding ahead turbines, and thus all four shafts are available for astern working.

The working steam pressure at the engines is 205 pounds per square inch. The high-pressure ahead and astern turbines are, as already indicated, of the Parsons' combined impulse and reaction type, each being provided with an impulse wheel at the high-pressure end. Each impulse wheel carries a single stage of impulse blading, consisting of four rows of rotating blades with their corresponding guide vanes. The nozzles are arranged in groups in such a way that a high initial pressure may be maintained when the turbines are working at reduced powers, as the supply of steam may be shut off from one or more of such nozzle groups. Following the impulse blading are the usual stages of reaction blades, seven in number in the case of the ahead turbine, whilst the astern impulse wheel is succeeded by two short stages of the reaction blading. Great care has been bestowed upon the design of the blading of the impulse stages, and particularly upon the method adopted for its attachment to the rotors. With the exception of the last row of moving blades, which are of brass, these blades are of special nickel-coated mild steel, welded on to sectional foundation rings of mild steel. The foundation rings are dove-tailed into grooves on the wheel rim, to which they are fixed by brass packing caulked into one side of the groove. The rotor drums, spindles, connecting pieces and impulse wheels are made of forged steel; the rotor wheels are of forged steel of the arm type.

The combined high-pressure ahead and astern arrangement, together with the introduction of impulse wheels and a two-stage cruising element in one casing, necessitated the construction of a turbine of exceptionally large over-all dimensions. These features constituted a departure from the usual practice in marine turbines of high power, and it was consequently found necessary to exercise great care in preparing the detail designs of the rotors and casings, so as to insure sufficient strength and freedom from distortion under the varying steaming conditions which will obtain on service. The two low-pressure turbines are on the reaction principle throughout. The object kept in view is a high economy under high and cruising speeds.

The screw propellers are four in number, three-bladed, of manganese bronze, the blades and boss forming one casting. Complete forced lubrication arrangements are provided for the turbine and plummer-block bearings, the oil being supplied by direct-acting pumps, two of which are fitted in each of the four engine rooms. The oil is passed through coolers of the tubular type, the circulating water for which is supplied by a direct-acting pump fitted in each of the four engine rooms. The four main condensers fitted, two in each condenser room, are of the "Uniflux" type, with the tube casings built up of steel plates and angles. The end covers are of cast iron to protect the tubes, etc., from galvanic action. There are two independent air pumps for each pair of main condensers, the pumps being of the "Dual" type, each having one air and one water barrel. The circulating pumps for the main condensers are of the centrifugal type, two for each pair of main condensers. The pumps are driven by independent two-crank engines fitted with forced lubrication. Two auxiliary condensers, one in each condenser compartment, take the exhaust steam from the auxiliary machinery. In connection with the auxiliary condensers, two air and two circulating pumps are provided.

In the boiler room there are eight main and eight auxiliary feed engines of the direct-acting type; the capacity of the auxiliary feed service is equal to that of the main. There are four grease extractors in connection with the delivery pipes of the main air pumps and two for the auxiliary air-pump discharges. Fourteen steam pumping engines are fitted for fire and bilge purposes and for emptying the double bottoms of the compartments.

Four of these pumps are fitted in the engine rooms and the remainder in the boiler compartment; those fitted in the boiler rooms are also capable of being used in connection with the See ash ejectors, ten of which are provided.

The thirty-six water-tube boilers in the ship are of the Yarrow large-tube type, arranged to pass the products of combustion into three funnels. They are loaded to 275-pound pressure per square inch, and are arranged to work under forced draft with closed stokeholds. The boilers are arranged to burn oil fuel as well as coal; a complete installation of pumps, heaters, filters, and collectors, with all connections, being provided and fitted complete for this purpose. Electrical indicators for regulating the firing of the boilers are fitted complete in the boiler room, the furnaces being numbered to correspond with numbers which are periodically displayed on the indicator dials. Five steam-driven air compressors are fitted for cleaning the boiler tubes externally by air jet.

The fans for supplying forced draft to the boilers number thirty-four—thirty-two of the single-breasted and two of the double-breasted type. They are driven by double-acting steam engines fitted with forced lubrication. The six evaporators are worked with steam taken from the auxiliary exhaust system or the auxiliary steam service. The two distilling condensers are of the cylindrical type, capable of condensing all the steam from any four of the evaporators. All the evaporators are connected so that any of them can deliver their vapor either to the distiller or the auxiliary condenser in their own compartment.—*Engineering.*

The Japanese Navy has received from England one 15.2-inch gun. It is their intention to place guns of this caliber on a battleship to be built in Japan and to be finished in 1915, probably the *Fuso.*

A MONSTER DIRIGIBLE.—The Japanese Navy will shortly be in possession of one of the largest dirigibles in the world. It is 310 feet long, with a cubic capacity of 580,000 feet, and is propelled by six screws, each driven by a 120 horse-power motor. The speed in still air is to be sixty-eight miles an hour. It is of the semi-rigid or Parseval type, and the total lifting power is no less than 42 tons, which will enable 20 tons of petrol to be carried, giving a cruising radius, out and home, of over 4000 miles. The new dirigible is to be completed in July, and will be stationed at the naval base at Yokosuka.—*Army and Navy Gazette.*

Extensive improvements in the yards, docks and machine shops are being made at the Japanese Government dockyard at Sasebo, about 46 miles north of Nagasaki. The large wharf is about half completed, and when finished will be the largest of its kind in the East, accommodating eight large battleships at one time. It will be connected with the railroad. The construction of a dry dock 777 feet long, 111 feet wide at the bottom, and 38 feet deep is about completed. This dry dock will accommodate ships of 30,000 tons, being the largest in the East. The engine works, machine shops, foundry, etc., are being extended to facilitate the execution of all kinds of work at the yard.—*Shipping,* Illustrated.

JAPANESE NAVAL POLICY.—The *Marine Rundschau* publishes an account of an essay by Captain Nischimoto, of the Japanese Army, in which he claims that the territorial acquisition in Manchuria is an element of weakness. He claims that the sea girdle is essential to Japan's development and Japan should confine herself to the island territory as England bears that relation to the European Continent. But it was answered that Japan has made her choice by acquiring the Asiatic mainland in Korea and Manchuria and must abide by it.—W. H. B.

COAL SUPPLY.—Rich coal areas have just been discovered on the island of Futago near Takashima Island where the Mitsubishi coal mines are operated. Rich deposits of coal have also been discovered at Hamheung, Corea.—*Marine Rundschau.*

DOCK YARD NOTES.—The labor question is beginning to trouble the Japanese. A strike among the workingmen at the Kure shipyard was finally broken after one week's duration by the intervention of the police. The patriotism of the Japanese laborers has been highly praised, but with the development of the industries the socialistic question will arise and a strike cannot so readily be quieted by the arrest of the ringleaders. After six days, out of 30,000 workmen, there were only 939 who still held out. The Japanese are threatened with another financial stress. The government has issued a new series of treasury notes and paid expenses amounting to $100,000,000 by this issue of notes. Increased taxes are threatened and the increased cost of living is felt in Japan.—*Marine Rundschau.*

ABANDONMENT OF TOGO'S BASE.—The Japanese journal, Asahi, states that after the completion of the military port in Chinhai Bay the naval base at Takeshiki, on Tsushima Island, that was used by Admiral Togo, will be abandoned. The engineering building that was destroyed by fire at Takeshiki will not be rebuilt. The Takeshiki torpedo destroyer base has been transferred to Sasebo and Makung (Formosa). Sasebo and Chinhai support each other strategically, and the base at Takeshiki is no longer necessary. It is probable that Takeshiki will continue to be used as a torpedo-boat depot.

The port at Chinhai will be also a commercial port. It has now 20,000 inhabitants and it is purposed to make Chinhai the center of fisheries in Southern Korea. The railroad from Chinhai to Chyanguon will be begun next year.—*Marine Rundschau.*

ACCIDENT TO "NANIWA."—A Reuter telegram from Tokyo, dated June 27, states that the Japanese cruiser *Naniwa* is ashore on the Kuriles. The vessel struck at 11 o'clock on the morning of June 26 on Brotona Island, and was beached to prevent her sinking. The crew were landed, and there were no casualties. The nearest warship was 500 miles away, and was proceeding to the spot, as also were salvage vessels from Yokosuka. The *Naniwa*, which was launched at Elswick more than 25 years ago, is about 3700 tons displacement. In July, 1894, at the time of Japan's war with China, the *Naniwa* had an engagement with the *Tsi Yuen*, and afterwards sunk the *Kowshing*. She also took part in the battle of the Yalu.—*Army and Navy Gazette.*

PREMATURE GUN DISCHARGES.—The accident on the *Satsuma* by which the plug of a 12-inch gun was blown out, mentioned in last issue of the PROCEEDINGS, is attributed to a faulty design of breech mechanism. On April 2 the plug of a 3-inch gun on the *Hashidate* was blown to rear, killing one and wounding eleven. These accidents are blamed on premature explosions, the gun firing before plug was locked in both cases.

RUSSIA.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Sevastopol	23,300	23	12 12-in., 16 4.7-in.	Baltic Works	Launched June 29, 1911
Petropavlovsk.	23,300	23	same	" "	" Sept. 9, 1911
Poltava	23,300	23	same	New Admiralty	" July 10, 1911
Gangut	23,300	23	same	" "	" Oct. 7, 1911
Emperor Alexander III	22,500	21	12 12-in., 20 4.7-in.	Ivan Bunge Co.	Building
Empress Marie	22,500	21	same	" " "	"
Catherine II...	22,500	21	same	Nikolaieff	"

"GANGUT" CLASS.—The sketch on page 775 of No. 142, showing the *Gangut* class, is in error.

The four turrets are on the center line, No. 2 turret and No. 2 stack having been moved far enough aft to enable No. 2 turret to swing clear of No. 1 stack.

SUBMARINE.—A cruiser submarine is being designed which displaces 4500 tons. It will have a radius of action of 18,500 miles with a speed of 11 knots, while it has a maximum speed of 25 knots on surface and 14 knots submerged. It submerges in three minutes, and has a radius of action in that condition of 750 miles at 6 knots. It will carry 36 launching tubes, five 5-inch guns so as to able to fight above as well as below water.—*Moniteur de la Flotte.*

COLLIERS.—The Russian Government has been offered a guaranteed supply of 164,000 tons of Don coal annually for the Baltic fleet. The Ministry will furnish three million roubles to provide ten colliers of 7000 tons coal carrying capacity from Mariupol to the Baltic. The colliers will become the property of the Russian Government.—*Marine Rundschau.*

BUDGET.—The Russian Douma has finally passed the budget submitted by the Minister of Marine, which amounts up to $79,500,000. The report shows that of this sum $27,250,000 are for ships, $12,000,000 being reserved for the Black Sea fleet.—*Moniteur de la Flotte.*

This five-year program will provide for four big battleships with twelve (nine according to some authorities) 35-centimeter guns and 27 knots speed, with four scouts of 7000 tons with 15-centimeter guns (some state six and others nine scouts) with 36 destroyers and 12 submarines.—*Marine Rundschau.*

The available shipyards are not able to build more than 30 per cent of the ships required by Russia in the next five years, and for this output the shipyards have to be extended and equipped with machinery, which will involve the outlay of many millions of roubles. This is chiefly caused by the fact that the future *Dreadnoughts* are to be 700 feet long as against the 590 feet length of those now building. Private shipyards are to be specially considered in placing the future orders.

The budget includes the following war vessels for the Baltic, which are to be commenced at once: Four armored cruisers of 28,000 tons and a speed of 27 knots, with an armament of twelve 14-inch guns, placed in four armored turrets. These vessels are to be built at the Imperial dockyards. The private shipyards will receive orders for four cruisers of 8000 tons displacement and for thirty-six destroyers of the *Nowik* type. There are further twelve submarines of the *Black Sea* type to be constructed. A new base for the Baltic fleet is to be established at Reval, for which a large equipment of machinery will be required.—*Marine Engineer and Naval Architect.*

TURKEY.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Reshad-I-Hamis	23,000	21	10 13.5-in., 16 4.7-in.	Barrow	Building
Reshad V.....	23,000	21	same	Elswick	"

The Turkish Government has made important additions to the plans which were originally drawn up for the reorganization of the naval arsenal at Constantinople. The original proposal to grant a concession to a private company to carry on the business of the arsenal has fallen through, and it is now reported that the government will no longer confine themselves to developing and modernizing the Golden Horn establishments, but will construct a new naval harbor and arsenal. For this purpose the Gulf of Ismidt and the Asia Minor bank of the Sea of Marmora, between Djirmen-Dere and Kazikli, have been suggested. To supplement the naval harbor at Ismidt it is proposed to establish another harbor for torpedo-boats at Laz-Bournou, a strip of land on the Asia Minor bank, opposite Stambul, and in this connection the Ministry of Marine recently published a notice inviting contractors for quay works, etc., to send in estimates. In addition to a quay, it is said that a breakwater will be erected there, as well as stores for ammunition, coal and drinking water.—*Shipping*, Illustrated.

The Admiralty has worked out an extensive naval construction program which includes twenty vessels to be built in the course of the next six years. It is stated that the Admiralty is already negotiating with leading English shipyards to undertake their construction on terms similar to those of the two *Dreadnoughts* now being built in England.

The increase of the fleet has shown that the existing dockyard in the Golden Horn is insufficient, and therefore the plans of the Admiralty suggest the establishment of a new dockyard on the Bay of Ismidt on the opposite coast of Asia Minor.—*Marine Engineer and Naval Architect.*

UNITED STATES.

VESSELS BUILDING.

Number	Name	Displacement	Speed	Armament	Where Building	% of Completion		
						June 1	July 1	Aug. 1
	Battleships							
32	Wyoming....	26,000	20.5	12 12-in., 21 5-in.	Cramps	98.3	99	99.3
33	Arkansas.....	26,000	20.5	same	Camden	97.4	98.7	99.3
34	New York....	27,000	21	10 14-in., 21 5-in.	N. Y. Navy Yard	40.1	44.5	48.2
35	Texas.....	27,000	21	same	Newport News	66	68.8	72.1
36	Nevada.....	27,500	20.5	10 14-in., 21 5-in.	Quincy	....	2.4	4.0
37	Oklahoma....	27,500	20.5	same	Camden	.7	2.1	3.3

"TEXAS."—The principal dimensions of this vessel and the *New York* are: Length, 573 feet; beam, 95¼ feet; draft, 28½ feet; displacement, 27,000 tons; speed, 21 knots; ten 14-inch guns; twenty-one 5-inch guns, 19 of which are mounted on the main deck, 10 being in a central battery protected by 6-inch armor. The remaining two 5-inch guns are mounted on the superstructure near the conning-tower. The water-line belt is of 12-inch maximum and is complete. A stroke of 9-inch armor extends above this to the main deck. Transverse bulkheads are of 10-inch. Turrets are 12-inch. Reciprocating engines.

U. S. S. "ARKANSAS" AND "WYOMING."—These vessels are 562 feet in length; beam of 93 feet 2½ inches; draft of 28 feet 6 inches; full-load displacement 27,243 tons, with normal displacement of 26,000 tons. There are four shafts driven by Parsons' turbines. Coal capacity is 2500 tons, and 400 tons of oil are carried in addition.

There are twelve 12-inch 50-caliber guns, with twenty-one 5-inch 51-caliber guns, and two 21-inch submerged torpedo-tubes. Armor belt is 11 to 9 inches, upper belt 10 to 8 inches, and turrets 12 inches.

SPEED TRIALS.—The *Wyoming* made a maximum speed of 22.045 knots on her trials. In her trial trips the U. S. S. *Wyoming* not only made a splendid speed record, but did it at a minimum consumption of coal. On her four-hour full-speed trial she made an average speed of 21.223 knots per hour. Her specifications called for 20.5 knots per hour, thus exceeding her contract speed .723 knots per hour. In her standardization trials the highest run was 22.055 knots per hour. Her best showing was on her twenty-four hour nineteen-knot endurance run, when she consumed only 350 tons of coal. Her sister ship the *Arkansas*, consumed 369.63 tons of coal on the same run. The *Wyoming* made her endurance twelve-knot trial with a consumption of 144 tons of coal, against 157.284 tons for the *Arkansas*. The *Wyoming* is .17 of a knot faster than the *Arkansas*, according to the records made in the four-hour full-speed trial.—*Army and Navy Journal.*

Official figures of the recent builder's acceptance trials of the battleship *Arkansas*, show an average speed of 20½ knots an hour for four hours. The figures follow: Fastest mile on standardization trial, 21.493; average of five high-speed runs, 21.153; average of 4-hour run, 21.051; average on 2-hour run, 20.989; maximum horse-power developed, 29,271.—*Shipping*, Illustrated.

The new drydock No. 4 at the navy yard, Brooklyn, N. Y., which has been finally constructed after many difficulties and the failure of several contracting firms which undertook the work, was well tested on May 9, when the 21,000-ton battleship *Utah* was successfully docked. The structure is large enough to take in a vessel 690 feet long and 110 feet beam, or approximately 40,000 tons displacement. It is 728 feet long and 120 feet broad. It is built of reinforced concrete, lined and trimmed with vitrified brick and Massachusetts granite, and is the first of three drydocks of the width of the Panama Canal to be completed. The firm that finally completed the work was Holbrook, Cabot & Rollins, a Boston corporation, on a bid of $1,369,000. After much difficulty with quicksands Civil Engineer Frederic R. Harris, U. S. N., who had been assigned to the yard, suggested the use of pneumatic caissons for the dock construction. This plan was adopted. The dock, all told, has cost about $10,000,000. The entire proceeding of guiding the *Utah* to the dock, adjusting her over the keel blocks, of setting in place the gate and of pumping out the water within the docks consumed little more than three hours.—*Army and Navy Journal.*

TRIAL OF THE "BEALE." June 27.—The torpedo-boat destroyer *Beale*, built for the government by the Cramp Shipbuilding Company, returned to the yard of the company after a successful builders' trial trip.

The boat made a maximum speed of 33¼ knots in several tests off Lewes, Del. This is a new record for the Lewes course. The boat's contract called for 29½ knots an hour.

DESTROYER SMOKE ELIMINATION TESTS.—Steaming at a rate of 30.5 knots in a run of two hours at full speed, the *Mayrant* won the speed and smoke elimination tests of the third group of destroyers of the Atlantic fleet run off Newport June 18. The *Walke*, 30.3 knots, was second. The *Perkins*, with a broken blower, was placed third with a record of 30.2 knots. Speed conditions were two hours, straight ahead. Four hours was the time for the smoke elimination trials. Smoke elimination is regarded as important, for the destroyer showing the least smoke would be most useful in action.

The *Mayrant* did not show any smoke. The *Walke* showed smoke 8 minutes and the *Perkins'* funnel was discharging for 19 minutes 2 seconds. The destroyer *Patterson* holds the navy speed record with 32.9 knots.—*Shipping*, Illustrated, June 22.

The U. S. submarine, *G4*, the first vessel of her type to be built in this country, was launched August 15, at Cramp's shipyard, Philadelphia. The *G4* was built by the American Laurenti Co. at the Cramp yards from the designs of the Fiat San Giorgio Co., of Spezzia, Italy. The length over all is 157 feet 5¾ inches; beam, 17 feet 6 inches; displacement in surface cruising, 358 tons and displacement submerged, 458 tons.—*Shipping*, Illustrated.

ORDNANCE AND GUNNERY.

GUNS AND PROJECTILES.

The latest British battleships are to carry a "13.5-inch A." As this gun is known to be designed for a 1400-pound projectile in place of a 1250-pound one, it is not improbable that the "13.5-inch A" will turn out to be akin to the "12-inch A" of glorious memory. In the latter case "A" stood for "plus 1½ inch." There seems to us something rather fatuous about mysteries of this sort. No one is deceived except those whom there is no object in deceiving. The secondary armament of the new ships will consist of 6-inch guns—which should never have been given up when *Dreadnoughts* were introduced.—*Engineer.*

LEWIS AUTOMATIC GUN.—On the *Nettuno* Admiralty range at Anzio, near Rome, a series of ten days test trials against airships with guns specially constructed by Messrs. Krupp for the Italian Government has just been terminated. The tests, which were executed in the presence of the Minister for War, General Spingardi, and the On. Leonardi Cattolica, First Lord of the Admiralty, besides a commission of experts appointed by the government and the representatives of the Krupp firm, were made first against balloons, to represent airships, towed at the rate of 12 knots and at the distance of about two kilometers from the beach. The balloon kept at various heights, was made fast to a ship, which was in its turn towed by a torpedo-boat. Another experiment was made with two balloons of 15 cubic meters and 25 cubic meters respectively, launched at the same moment into the air at 5 kilometers distance. These were both set on fire. The gun, which is of 70 mm. caliber, with an inclination of 75 degrees, has a range of 7 kilometers. The course of the projectile fired is marked by a slight smoky trail which enables the gunners to adjust the aim.—*The Engineer.*

ARMOR VS. GUN.—There is a tendency to increase armor thickness as the size of ships increases, and in the most recent United States ships this has been done, but increases hitherto made can hardly be regarded as adequate, and it must be admitted that at the moment the gun is superior to the armor. Whether the armor will again forge ahead by superior combination of old elements, the development of still further improved armor, or the devotion to armor of a larger proportion of the displacement, it is impossible to say, but there is great need for improvement in protection, and it would seem fairly safe to prophesy that for some years to come we may expect to see the protection developed relatively more rapidly than the attack. I think that is certainly the proper and much-needed line of development. An alternative is to give up the fight and practically abandon armor.—Extracts from a paper *Recent Advances in the Art of Battleship Design*, by Naval Constructor D. W. Taylor, U. S. N., appearing in the Journal of the Franklin Institute.

TRACER SHELL.—That the Japanese are determined to do more night fighting than ever in the next war may be inferred from the fact that they have introduced into the service an illuminating 50-pound shell for the heavy field gun, containing sufficient magnesium composition to give a bright light for fully twelve minutes. In battle, salvoes of these shells will be fired into an enemy's works before the assault is delivered. It has been found by experiment with dummy figures that the defenders when they stand up to fire are sharply silhouetted against the light, enabling the attacking infantry to take good aim at them while themselves lying invisible in the dark. The Russians, too, have learned their lesson as to night fighting from the Manchurian War, and are issuing searchlights at the rate of one per regiment to permit the delivery of well-aimed rifle fire at night both in attack and defence.—*Army and Navy Journal.*

LEWIS GUN.—No smoke, no flame—only the sound of the explosion tells that the gun has been fired. There is no recoil and the gun is so balanced by the magazine that the aim is not even interrupted while the gun is being fired. It can be fired at as high a rate as 750 shots a minute, but the rate may be reduced to 350 shots per minute, or to any number between these limits, by a simple adjustment of the gas-port valve controlling the admission of the gas to the piston cylinder.

The principal and most novel feature of the gun is its air-cooling system. The 30-caliber gun barrel is surrounded by a close-fitting aluminium jacket, cylindrical in form and having some twenty deeply cut longitudinal grooves which extend from breech to muzzle. The gun barrel with its grooved jacket is inclosed in a light steel tube 3¾ inches in diameter, the portion of the tube which projects beyond the muzzle having a reduced diameter of only 2⅞ inches. The inclosed grooves, forming continuous air ducts in the aluminium jacket throughout its length, have free communication with the atmosphere at the breech and each time the gun is fired the ejector action of the discharge blasts sucks in a draft of cool air from the rear through these ducts, thus carrying off the heat transmitted to the jacket from the barrel. The cooling is automatic in action, without the use of water or other cooling liquid and without mechanism or moving parts. As aluminium has six times the heat conductivity of steel and but one-third its weight, this very effective method of cooling the gun adds but a few pounds to the total weight carried. Another novel feature which differentiates the Lewis gun from all other gas-operated guns is the small inclosed operating spring which is located near the trigger piece at the breech far removed from all injurious heat effects. The temper of this spring cannot be affected by either direct or transmitted heat no matter how rapid and long continued the firing.

When firing at full speed it takes approximately four seconds to discharge a magazine of fifty cartridges, and the empty magazine may be replaced by a full one within two seconds. The drum magazine used with this gun is 8¼ inches in diameter and 1½ inches deep. It is stamped from sheet steel, has an aluminium center piece to hold the cartridges in place, and resembles, somewhat, a reel used for winding cinematograph films.—*Scientific American.*

The latest firing by the army aviators was at a height of 600 feet, the aeroplane traveling at a rate of 50 miles an hour. Captain Chandler, who fired 50 shots, delivered them within a rectangular space of three yards by fifteen yards. Had the machine been 6000 feet in air, the deck of a battleship would present approximately the same target with a result of 100 per cent of hits. Captain Chandler is of the opinion that it is possible to carry in an aeroplane 1000 rounds of ammunition in the drum magazines with a maximum total weight of 100 pounds.

THE TACTICAL USE OF BATTLE-CRUISERS.—Reasoning theoretically, what *is* the plan for using battle-cruisers in future battles? Besides the part of a

TABULATED COMPARISON OF BIG GUNS IN BATTLESHIPS OF THE NAVIES OF THE WORLD.

Data of Guns.	Italy.	England.		Austria.		France.		United States.	Germany.			Japan.	
	Model 1906.	Mark XII.		Skoda.					Krupp.	Krupp.	Krupp.	Vickers.	Armstrong.
Caliber in inches..	12	12	13.5	12	12	12	13.4	14	12	14	15	12	13.5
Length in calibers.	46	50	45	45	50	50	45	45	50	50	50	50	45
Weight in tons....	64	69	80	54	61	61	67	65	53	83	102	67	73
Weight of projectile, lbs.	920	850	1,240	990	990	960	1,320	1,400	850	1,360	1,650	850	1,240
Initial velocity, f.s.	2,800	2,950	2,800	2,600	2,750	2,800	2,600	2,600	3,000	3,000	3,000	2,900	2,700
Energy at muzzle in metric tons.	15,300	16,540	22,150	14,680	16,570	17,100	20,250	20,320	17,510	27,650	33,910	16,000	19,568
Energy per kilogram in kilogm. meters.	240	240	277	270	280	280	301	310	330	330	330	248	268
System of construction.	Wire.	Wire.	Wire.	Built up.	Built up.	Built up.	Built up.	Built up.	Built up.	Built up.	Built up.	Wire.	Wire.
Probable life.....	80	60	60	200	200	200	200	150	220	200	200	80	60
In what class battleships installed.	Dante Alighieri.	Australia.	Queen Mary.	Zrinyi.	VI	Paris.	Lorraine.	Oklahoma.	Oldenburg.	Kaiser.	Weissenburg	Kawachi.	Kongo.
		Neptune.	Lion.	Radetzky	VII	France.	Bretagne	Nevada.	Helgoland.			Settsu.	Fuso.
	Cavour.	St. Vincent.	Centurion.	Viribus Unitis.		Courbet.	Provence	Texas.					
	Doria.		Orion.			Jean Bart.		New York.					
	Duilio.		Conqueror.										

NOTE.—From "Mittheilungen aus dem Gebiete des Seewesens." Centimeters reduced to inches by multiplying by 4. Kilograms reduced to pounds by multiplying by 2.2. The correctness of this table appears only approximate and even then the figures of German ordnance show such a superiority to foreign ordnance that one can seriously question the accuracy of the table. Note the marked superiority of the German 14-inch over our 14-inch and the English 13.5-inch.

scout, which their great speed and their large bunkers allow them to always fill, these powerful ships will be able to undertake the destruction of the enemy's commerce, to close many of its numerous dockyards, and thus contribute to its defeat on the field of battle.

These ships can be used during a battle to win an advantageous position with respect to the enemy's line, to prevent the T, or to turn it, as well as being employed by the stronger fleet to take care of the weakest portions of the line in battle. These ships of speeds of 28 knots and more can reach any battleship, and being armed with the heaviest guns in service, they are capable of forcing the largest of a fleet in retreat to choose between losing a part of its force or of resuming the fight.

It appears from the above that the stronger fleet alone is concerned in possessing battle-cruisers and that the nation which can not hope to have the advantage in numbers ought on the contrary to devote all its means to the building of battleships alone.

The necessity of annihilating first of all the principal fleet of the enemy is more and more important and requires the concentration on the main battle field of all the force that one possesses. So England can not hope to be able actually to part with her *Invincibles* and *Lions* in order to protect her commerce against the enemy, since she does not consider it wise to maintain a force in the Mediterranean which is judged too far from its own coasts where the fate of the nation will be decided.

Thus the English battle-cruisers are attached strictly to the squadrons and will take a direct part in the fight.

It will be the same with the German division, *Von der Tann, Moltke, Goeben*, and *Seydlitz;* the German battle-cruisers will not be able to devote themselves to the destruction of English commerce without passing by the north of England in order to avoid the danger of the fleets of Harwich, Rosyth and Dundee, and returning by the same route to revictual, and after such a long detour will be able to keep the sea but a short time. There being no way of disposing of prizes the battle-cruisers will be unable to fulfill this plan. Furthermore there is the menace of the English fleet 60 per cent stronger than theirs, the Germans will thus have to retain all the capital ships in their fleet. Thus it seems certain that all battle-cruisers will stay with the battle fleet.

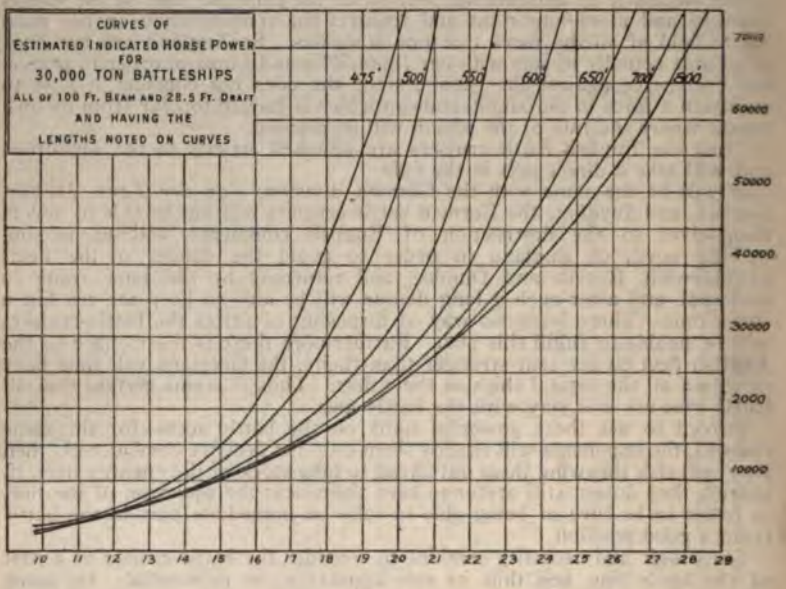
Forced to use these powerful units on the battle scene for the same reasons, the opponents will employ them only for decisive combat, only then they will risk throwing them out ahead to take stock of the enemy's fleet, if, indeed, they do not still prefer to keep them near the squadron of the line, in order to be sure of being able to take an immediate part in the battle from a good position.

Thus logic and necessity combine to consider the battle-cruiser as a part of the battle line, and thus its role appears to be primordial. Its speed permits it to give to the enemy's line, held under the fire of the battleships, some blows that its heavy guns render of moment, it will force the enemy's line to maneuver under the fire of its own line; it will turn the head of the line and disable the flagship; it will create finally the diversion necessary to win.

Battle-cruisers are thus necessary to a line of battle fighting another battle line having them, and it is most desirable to keep them when the enemy has lost hers.

The French armored cruisers can not fulfill the role of scouts on account of their slow speed, they will not be efficient against those of their adversaries, having to retreat from the *Moltkes* and *Lions*. In the battle, they cannot be used if the latter enter the fire. Our costly armored cruisers thus become useless; it is thus necessary to build battle-cruisers. Far from weakening our battle line, they will assure it the flexibility which now our battle line composed of ships of one speed does not possess. They will permit the squadron commander to increase his range of tactics and the number of his movements.—*La Vie Maritime.*

BATTLE-CRUISERS.—At present there *is much doubt* as to whether the *Moltkes* and *Lions* carry sufficient fuel to enable them to use their high speed in the battle line. Their steaming radius at low speeds is low, and hence the force of the argument that they can engage where and when they will in action probably does not apply. Cruising at uneconomical speeds with the battleships prior to the battle will have utterly depleted their fuel supply. Thus they, at least those at present built, can only perform the duty of being a flexible unit of the fleet in battle. From the results of the *Moltke's* cruise to the United States it developed that, if she were to accompany a fleet, when the day of battle came, she would not have sufficient fuel to allow her to be even the flexible arm. It is difficult to believe that the *Moltke* class can be considered in any other light than failures. The *Blucher* has been the only great success in the all big-gun cruiser type, and she carries but 8-inch guns. The low freeboard aft of the



Moltke is a serious drawback on the high sea. As accounts of her state that her deadwood forward and abaft the rudder is cut away to give her great maneuvering power she must be a very bad roller at sea, and such has proven the case. The English *Orion* class has the same defect. The contour of the *Moltke's* bow gives one the impression that she must pitch heavily and deeply. So far a proper type of battle-cruiser has not been evolved. If we have great speed, we must have large boiler and engine rooms, and consequently the armor must be light, especially as the steaming radius should logically be very great. The last requirement is difficult with high-speed turbines and the *Moltke* proved herself a huge fuel consumer on her run across the Atlantic. How some of the requirements put limits on what the vessel can do is shown in the following extract from an article by Naval Constructor D. W. Taylor, U. S. N., in the *Journal of the Franklin Institute:*

Ratio of Speed to Length.—The influence of length upon speed, sometimes enormous and always important, is obvious from the above diagram.

If we assume that in each case we could put a maximum of 70,000 horse-power into the vessel, which is somewhere near the truth, we see that if she were made 500 feet long the speed would be twenty-one knots, whereas if she were made 800 feet long the speed would be twenty-eight knots.

It is doubtful if sufficient length and space could be given to machinery in a 500-foot vessel to enable 70,000 horse-power to be developed; probably it would not be possible to drive such a vessel over twenty knots, owing to limitation of space for machinery.

Assuming, for the present, that we could get 70,000 horse-power into each vessel, the weight of machinery would be approximately the same, regardless of the length of the vessel; but to build a 30,000-ton vessel 800 feet long would take a very much greater weight of hull than to build a 30,000-ton vessel 500 feet long. This additional weight of hull would have to come from the armor or armament, the 30,000 tons of displacement being fixed. Moreover, the thickness of armor protection for a given weight which could be placed on an 800-foot vessel would be very much less than for the same weight applied to a 500-foot vessel.

It is evident, then, that the penalty paid for speed besides the direct weight necessary to provide for machinery is the additional weight of hull necessary to provide a vessel of the length and form to enable it to be driven at the higher speed, and, superposed upon this, the diminution of the armor thickness, or the restriction of the proportion of the area of the ship protected by armor resulting from the greater length to be protected. The solution of the problem of speed is then obviously a compromise between conflicting considerations, as is the case of so many other problems of warship design.

FIRE CONTROL.

FIRE CONTROL.—The *Thunderer* has been equipped with the Sir Percy Scott central control or "director." It is remembered that the *Neptune*, the first ship to be so fitted, underwent extensive firing trials in the Mediterranean last year with Sir Percy Scott on board. The success of the firing and the sureness of its control led to the placing of these instruments in the *Thunderer*, the second ship so fitted. The fire control officer's station is on the tripod mast abaft and sufficiently above the forward funnel to be clear of heat and smoke. He is placed on a platform at the head of the tripod mast and underneath the steel turret in which are the instruments of the control system.

In English vessels of the *Neptune* and *Indefatigable* classes the masts fitted with fire control stations are forward of the funnels. In the vessels following these, the *Lion* et seq., the fire control position was abaft the funnel, and control positions fitted on the conning-towers.

If a control position aloft is to be used it should certainly be high and where no smoke or hot gases could obstruct clear vision. Tendency appears to be to bring control positions down to a lower level, to armored towers.

The following description of a new range and deflection indicator is taken from *The Naval Annual*. It is called "Follow the Pointer" system. A large dial, with an electrically controlled pointer, is fitted to each sight.

The dial is graduated, and there is an index point on the stationary part of the sight. When the range is transmitted from the control station the pointer is moved round from the zero towards the range at which the sight is desired to be set. The sight setter operates his control wheel so as to keep this pointer always opposite the index mark. This consists in altering the sight until the range on the dial, to which the pointer has been deflected, is brought opposite the zero mark. The same principle applies to the deflection gear.

The whole system comprises a simple transmitting switch, a plain drum with four contact pieces, one of which makes continuous contact, the others alternately engaging with cams. The receiving portion consists of a simple step-by-step motor mounted on a base plate, gearing with a worm and wormwheel of the spindle of the pointer.

The sight may be used with or without the gear, its removal or replacement does not make any difference to the sighting gear.

To the ordinary transmitter there is fitted the repeat receiver, which acts as an indicator to the transmitting number. This repeat receiver registers the transmissions, and thus in itself forms a separate unit, and is exactly in conjunction with the receiver attached to the sight.

Curiously enough, just as the British Navy is more or less ignoring the masts, the Germans have given it a fresh lease. All German ships are now being fitted with small crow's nests, presumably connected with the fire control system. These "nests" approximate very closely to those which the Austrian Navy has employed for some years, and which the American Navy indulged in just before the advent of "basket-work" masts. Previously to this the German ships used their turrets as fire control stations. England and Germany are apparently each by way of adopting what the other is by way of discarding! The presumption is that the ideal fire control station still remains to be discovered.—*Engineering.*

In connection with tripod masts, it is of interest to note that these have recently been fitted to nearly all Swedish battleships at just about the time when the indications are that they will disappear from the British Navy.—*Engineering.*

TORPEDOES AND MINES.

The endeavor to get great speed and great distance with these is ever continuous, but the two cannot go together. At the present state of development, Messrs. Whitehead now denote their two types of torpedoes as the swift torpedo, and the long range torpedo. The first type gives 45 knots speed up to about 1090 yards and averages 40 knots for 1840 yards. This type is for destroyers and submarines. The second type has a speed of 30 knots sustained for over 6560 yards. This is the torpedo for battleships.

SPEED AND EXPLOSIVE CHARGE OF LATEST TORPEDOES.

Diameter Torpedo inches.	Speeds in knots for distances of				Explosive Charge lbs.
	1000 yds.	3000 yds.	6000 yds.	8000 yds.	
18	42½	..	27	..	209
21	..	41	..	27	330

—*Brassy's Annual.*

The battleship *Kongo*, now building for the Japanese Navy, is stated to have a very exceptionally large number of torpedo tubes.

The Schwartzkopff torpedo is a superheated air turbine driven torpedo. Its air heater gives so little external heat that bronze is used for machinery parts.

POWDER.

FRENCH POWDER.—M. Daniel Berthelot, the eminent French powder chemist, had the following remarks, among others, to make on powders before the Society of Civil Engineers of France on June 21, 1912:

Decomposition.—The formation of the powder by the nitration of cellulose represents the chemical phenomenon of etherization, their decomposition, *i. e.*, denitration, represents the opposite phenomenon, that of saponification. These two chemical processes tend to act at the same time and thus establish an equilibrium varying with the temperature. Saponification is favored by the residual humidity of the powder—1 to 2 per cent.

The slow decomposition of powder B shows itself in three phases:

(a) The nitrous products formed are absorbed in the powder itself; no alteration is visible outside, and it is not dangerous.

(b) The critical stage in which the nitrous vapors become free and the reaction hastens.

In many cases this phase terminates in the complete ruining of the powder or third phase.

(c) The powder becomes an inert mass, and is not in the least dangerous.

But in certain exceptional cases—heated, quick action of moisture on the nitrous vapors formed during the drying period—the heat of reaction is sufficient to cause the powder to ignite spontaneously.

These exceptional cases are almost never realized on shore; they are much more apt to occur on shipboard—overheated and damp magazines. Seamen assign to these spontaneous ignitions many accidents that have happened in all the navies of the world.

Stabilizers.—A search for compounds for incorporation in the powder to prolong the life of powders has been made, they being mostly basic substances which are capable of neutralizing the acid products of decomposition. We have successively tried mineral compounds such as bicarbonate of soda, organic compounds such as camphor, urea, amyl alcohol, aniline, diphenylamine and triphenylamine. The diphenylamine is the one that keeps best the chemical and ballistic properties of the powder.

Stability Test.—The 110° C. test is most used in France. The English prefer the test in which the sample is placed in an isolated, double-lined silver heating base—called the Silver Test—heated in an oven to 80° C., and the time necessary to decompose the powder is measured, and in which the interior reactions of the powder raise the temperature 2 degrees. Recently M. Berthelot has introduced the ultra-violet test. This light is a precious agent for accelerating chemical reactions; in a few hours they produce phenomena, which left to themselves would not happen for many months and weeks. Furthermore, quality much desired, this light which as everyone knows plays the preponderant role in the chemical evolution of plants, presents the character, common to the greater part of natural agents, of being less brutal, less harmful than the usual agents of the laboratory, heat and electricity. The chemist and the physician of living beings put into play only the feeble agents, moderate variations of temperature, and weak currents of electricity. In researches with M. Gaudechon, M. Berthelot has stated that exposed to the ultra-violet rays, powders enclosed in test tubes of quartz, placed over a mercury bath, the degree of alteration of the powder and the comparative strength of stabilizers is recognized with certainty by an analysis of the gases given off. This new method should be used with the old to complete and control them.

Precautions.—The stability studies have proved that the decomposition starts always at a weak point, such as that of a fruit pierced which spoils. In this weak spot, we recognize either a bit of foreign matter—often a fragment of iron—or a local alteration of organic substance, proving a fault in the raw material or in manufacture. It is then necessary to watch with the greatest care the purity of the raw material, and to not employ dirty or greasy cotton as has often been done in the past; to forbid the process, which, through a false spirt of economy, has been used, that of *radoubage*—mixing old powders with new—or remixing, introducing the solvent that has evaporated. Particularly in the navy, there will have to be established regular inspections and tests of powders in magazines aboard ship and ashore.

Finally we should pass the law projects now in discussion which, without suppressing the powder monopoly, limits it, in permitting private concerns to manufacture for export and for the government, which will have the good effect of competition.

Future of Ballistic Powders.—Greek fire lasted ten centuries, black powder lasted five centuries, and how long will our nitrocellulose powder last? We are confronted with this problem, is it better to have mineral explosives stable but violent, or to have organic colloid explosives, progressive but unstable?

M. Berthelot does not believe so, and after as it were having felt the pulse by means of the ultra-violet rays of a great number of organic bodies, feels and asserts that there is a fundamental distinction between a straight body or structure, and a cyclic body or in a closed chain. The first are unstable; the second are stable. It appears that these chains have a mutual leaning, and that here is found a superiority in stability likened to that which the arch in architecture offers to the straight line. The day in which we discover a nitrous or nitric ether with a closed chain, which accords to practical needs, we will have a powder both stable as the ancient mineral powders and progressive as the modern organic powders.

But, while awaiting that day, which is perhaps not so very far distant, we agree that the formula and composition of our war powders is good; that it compares most favorably to the best of the foreign powders. When the faults in manufacture are remedied, if not entirely overcome due to the new inspection service, they will certainly reduce, to the extent of human foresight, the risks that our gunners and seamen undergo in time of peace.

TARGET PRACTICE.

FRANCE.—The first squadron fired the last of April. Firing was done: first school of fire, by two ships simultaneously which followed a guide, a distance of 9000 meters, each firing at a moored target; second school of fire, the ships, steaming in column following a guide whose speed, course and distance from the target was unknown, firing one after another, the target being kept between 8000 and 9000 meters. The four cruisers did excellently; the weather was fine.

The firing was controlled from the secondary stations. This requirement necessarily decreased the accuracy of the fire. The *Waldeck Rousseau*, flagship of Vice-Admiral Auvert, made 42 per cent of hits. The average percentage of hits was between 15 and 34.

The targets were two and were formed each of 5 elements of the large targets moored in the Iles d'Hyères passage. The range, unknown to the gunners, had 9000 meters as a minimum, and speed of ships was 15 knots. The firing lasted on each of the two runs 6 minutes, the guide at end of 3 minutes changing course two points.

The results of the firing do not give satisfaction, the long period of idleness and defective preparation being no doubt responsible for this. The matériel worked perfectly save for a slight accident in a *Patrie's* 12-inch turret.—*La Vie Maritime.*

During May the French fleet held its record firing off Toulon. Division firing was done first, the divisions passing at distance of 9000 meters. An evolution was executed during the firing on signal of the admiral. The results obtained were reported as very satisfactory. Single ship firing was done at 8000 to 9000 meters. Not an accident to matériel occurred, and guns and mounts are considered very satisfactory. The *Bouvet*, in the third squadron, did the best.

The third school of fire is this: Two targets are anchored 400 meters apart. The squadron in two homogeneous sections, two vessels each, is led by a guide at unknown speeds and courses. The range is about

9000 meters. On the first run the firing lasts nine minutes and is concentrated on one target. On the second run each ship takes one target. The firing lasts 14 minutes and is considered a severe test of the matériel.—*Moniteur de la Flotte.*

Scores were as follows:

FIRST SCHOOL OF FIRE.

		Hits.	Per cent.	Efficiency coefficient.
Voltaire.....	firing to starboard.....	7	22.6	11.7
	firing to port.....	7	22.1	9.7
Condorcet.....	firing to starboard.....	10	33	18.2
	firing to port.....	4	17.4	6.6
Danton.....	firing to starboard.....	18	52.9	31.2
	firing to port.....	7	24.2	15.7
Mirabeau.....	firing to starboard.....	6	19.4	10.1
	firing to port.....	8	20.5	14.6
Vergniaud	firing to starboard.....	2	11.1	3.3
	firing to port.....	7	25.9	11.7
Diderot.....	firing to starboard.....	11	30.6	12.4
	firing to port.....	13	37.1	21.5

The *Danton* did particularly well, in four minutes made 18 hits with 12-inch guns at 10,900 yards. It is evident that in a real action, the enemy's ship would have instantly lost all her maneuvering control.

SECOND SCHOOL OF FIRE.

		Hits.	Per cent.	Efficiency coefficient.
Voltaire.....	firing to starboard.....	15	33.3	16.7
	firing to port.....	12	30.8	11.7
Condorcet.....	firing to starboard.....	21	38.9	28
	firing to port.....	20	37.7	24.9
Danton.....	firing to starboard.....	13	31	15.2
	firing to port.....	22	48.3	27.5
Mirabeau.....	firing to starboard.....	9	17	14
	firing to port.....	16	30.2	23
Vergniaud	firing to starboard.....	4	9.3	4.5
	firing to port.....	14	31.1	15.6
Diderot.....	firing to starboard.....	14	29.8	16.4
	firing to port.....	7	16.3	8.3

During the second school of fire, the fire control was shifted from the primary position to the secondary position. In spite of this difficulty, the results are quite as good as in the first school firing, and ought to give us great faith.

The weather was generally good. The targets are considered very unsatisfactory, being destroyed by hits as a house of cards is blown down by the wind. Attention is to be given to developing a satisfactory target.

10,900 yards is considered the maximum target range.—*Moniteur de la Flotte.*

GREAT BRITAIN.—During gun pointers' tests off Lamlash, one of the pointers of the battleship *Collingwood* made a record. At a range of 2300 yards he made eight hits with eight shots from a 12-inch gun in 2 minutes. The best up to that was that of the *Orion* which made eight hits with eight shots from a 12-inch gun in 2 minutes and 8 seconds.

The *Orion*, before the King, carried out a battle practice, consisting of 28 rounds—four broadsides,—with her 12-inch guns resulting in 21 hits at 6000 yards in very foggy weather.

MARINE ENGINEERING.

BOILERS FOR NEW FRENCH BATTLESHIPS.—The Delcassé commission on boilers for the French Navy have decided to fit in one of the new battleships, the *Lorraine*, small tube boilers, the Guyot DuTemple, while her two sister ships, the *Bretagne* and *Provence*, are to retain the large tube boilers, Belleville and Niclausse, respectively.

OUR FIRST NAVAL OIL ENGINE.—The design of the New London Ship & Engine Co. for submarine tender No. 1, the *Niagara*, has been accepted by the Navy Department and to that concern has been awarded the contract for her construction at a cost of $492,930. The vessel will be equipped with a heavy oil internal combustion engine of the Diesel type and will be the first navy vessel to have such an engine installed, with the exception of the submarines themselves. In European countries this engine is used in merchant ships and in foreign navies in torpedo-boat destroyers and larger ships.

The turbines of the English cruisers *Amphion* and *Fearless* are of an entirely new design by the Parsons Marine Steam Turbine Company. These cruisers are to have a speed of 25 knots. The type referred to is the Parsons' combined impulse and reaction type of turbine, which was first ordered for the armored cruiser *Amphion*, a class of vessel larger than the *Scout*. The *Fearless* is also to be fitted with the combined impulse and reaction turbine, as well as another vessel of this class, the *Nottingham*, which will shortly be laid down at Pembroke, where most of this new cruiser class are being built. The number of propellers for these combination turbines has been reduced from four to two, but the vessels are designed to attain a speed of 25 knots per hour with 18,000 horse-power engines. The vessels are armed with ten 4-inch guns of the latest pattern and carry 350 tons of coal which gives them a very large radius of action at economical cruising speed. The new ships of the class are to have light vertical armor as well as protective decks of the turtle-back design. Their debut is looked forward to with much interest in naval circles.—*United Service Gazette.*

The French Admiralty is studying a system of turbo-reciprocating engines for the *Bretagne* type of battleship.

WOBBLING OF AMERICAN ENGINEERS.—It is curious that our cousins across the Atlantic cannot make up their minds concerning the relative merits of the turbine and reciprocating engines for their warships, as Americans have always been considered a very practical set of men, so that this policy of wobble is all the more incomprehensible. Moreover, it follows upon a long series of experiments carried out by American engineers, to settle this very question. We all remember the long ocean cruise of two sister battleships, and the subsequent decision that no more American warships were to be fitted with turbines. But now we learn that the battleship *Nevada*, whose keel has just been laid, is to have an installation of Curtis' turbines, while her sister ship, the *Oklahoma*, is to be driven by triple expansion reciprocating engines. Both ships are to use oil fuel only, and no coal will be carried either for main or auxiliary purposes, while the estimated speed is to be 20½ knots. At no point does the practice of the American and British designers differ more than in the driving department, for every British warship, from super-*Dreadnought* to submarine, is now fitted with turbines, the reciprocator having been finally and definitely abandoned so far as new construction is concerned. The development of the turbine is, in fact, a marked feature of our naval engineering, and our ships are now run by this type of machinery, without hitch or falter, year after year with economy and efficiency. The *Nevada* and *Oklahoma* will each displace about 27,500 tons, which is 500 tons larger than the preceding *Texas* class,

and so the many eggs in one basket policy continues its insane course in America, as in other shipbuilding yards in spite of the lessons of the *Titanic* disaster and all other dangers and difficulties.—*United Service Gazette.*

COMPLETION OF THE VOYAGE OF THE "SELANDIA."—This vessel, described on page 798 of No. 142 of the PROCEEDINGS, has just returned from her first round voyage which was of 21,840 miles. The *Engineer* has this to say of her trip: No defects whatever of a mechanical nature were developed and the officers of the vessel are satisfied with her performance. The piston rings and cylinders were found to be perfectly clean; the exhaust valve needed but regrinding and cleaning. 9300 tons of cargo can thus be carried nearly 22,000 miles on a consumption of but 9 tons of fuel for each day of 24 hours. This was done with an engine-room force of ten men and three boys.

MOTOR-DRIVEN WARSHIPS.—At last we are within sight of the first all-motor-driven warship for the British fleet. Messrs. Thorneycroft, the famous torpedo-boat builders, having offered to construct a new destroyer fitted with the Diesel engine, to burn crude oil. The Admiralty have accepted the offer and have placed an order for the vessel to be built. Our prediction, therefore, that the British Navy would introduce motors for main engines through the torpedo craft, just as turbines and oil-fuel and water-tube boilers were introduced, has turned out to be correct. That will-o'-the-wisp—the motor battleship—which enterprising and imaginative lay journalists have been chasing any time the last two years, will therefore remain grist to the conjectural pens, until marine engineers produce something more substantial with which we can begin main-engine motor experiments in our war fleet. The merchant fleet is ahead of the sister service, for it already has several large vessels, with considerable cargo carrying capacity, fitted with motors to drive their main engines. The projected destroyer will be one of the largest in our flotillas and will form part of the 1912-13 destroyer-building program. She will be fitted for cruising and performing all the functions of an ordinary vessel of this description, and will probably be constructed at Thorneycroft's new works at Southampton. Her progress will be watched with interest, although little doubt is felt in naval engineering circles as to the absolute success of the experiment, since the firm has already had considerable experience in motor work.—*United Service Gazette.*

In large powers a Diesel engine propelling equipment for a vessel costs something like 60 per cent more than the equivalent steam equipment, but it will occupy only 60 to 80 per cent of the space required for the latter, and the cost of fuel will be somewhere in the neighborhood of 30 to 40 per cent of the cost of coal. When the tremendous pressures and temperatures which are being dealt with in a Diesel engine, and the very fine adjustments which are necessary, are considered, it will be realized that it cannot be a cheap engine to build. Undoubtedly it will become cheaper than it is at present when more experience has been gained, but conservative shipbuilders consider it would be the greatest mistake possible to sacrifice anything, in either material or workmanship, for the sake of reducing the cost.—*Shipping,* Illustrated.

RUSSIAN OIL-ENGINED CRUISER.—The 3500-ton cruiser *Ruenda* should be finished in June. For some reason that is not apparent she is to have an electric reversing system, which, although used in the Amur River gunboats, was discarded in the Caspian Sea gunboats that were finished last year. The "inspection ship" building at the Nicolaieff yards should have been turned over in 1911, but she has been delayed. Her engines are of 750 horse-power, and those of the *Ruenda* are of 1200 horse-power. A floating workshop, 132 feet long, 28 feet beam, and 7¾ feet depth, is one of the most interesting jobs in hand, although she will be driven by a motor of

not more than 180 horse power, with auxiliary machinery of 30 horse-power. Bracketed with her in point of interest is a dredger with a main engine of 370 horse-power and 60 horse-power auxiliary. She is for the Black Sea, the workshop is for the *Neva*, the "inspection ship" for the Black Sea, and the *Ruenda* for the Baltic.—*Shipping*, Illustrated.

Tenders have been received by the English Admiralty for the construction of an oil-carrying ship of about 10,000 tons dead weight. She is to be driven by internal combustion engines of about 740 horse-power. This will be the fourth oil-tanker owned by the Admiralty, the others being the *Burma* of 3445 tons, the *Petroleum* of 9900 tons, and the *Isla* of 980 tons. She will be the first fitted with the new type of propelling machinery.—*United Service Gazette.*

SUPERHEATED STEAM.—Generally with steam turbines of modern design and carrying from 175 to 200 pounds of steam pressure there is a saving in steam consumption of about 1 per cent for each ten degrees of superheat.

The official trials of the *Kansas, New Hampshire, South Carolina* and *Michigan*, showed, by comparison, an average of 18.52 per cent economy due to superheaters.

A superheat of 100° or higher caused trouble with the valves, and fittings made of composition and cast iron. This is stopped by use of cast steel and valves with seats of bronze with a large percentage of nickel or monel metal.

The use of superheated steam up to 100° can be used with great satisfaction so far as practical service is concerned, with a decided increase in thermal efficiency.—W. M. McFarland in *International Marine Engineering.*

ROTARY AIR COMPRESSORS.—The following advantages are claimed for the rotary compressor driven by a turbine: It enables exhaust steam from other engines to be used either in mixed or low-pressure turbines; it gives a continuous delivery of air; occupies comparatively small space; and requires light foundations under which the condensing plant may be placed; it requires only a small amount of oil for lubrication and the air is delivered free from oil—a feature of importance when the air is required for some chemical purposes.—*The Engineer.*

TURBINE-DRIVEN PUMPS.—In a paper read before the American Society of Mechanical Engineers, Mr. A. G. Christie points out that the steam turbine is an ideal source of power to drive centrifugal pumps, especially when it is necessary to lift against high heads. Hence it has been used in several places for city fire service, using lake or river water in high-pressure mains. The efficiency of such centrifugal pumps usually ranges from 65 to 80 per cent, so that, in spite of the high efficiency of the turbine itself, the combined set will not give as good economy as a high-grade reciprocating pumping engine. However, its first cost is low, it requires no internal lubrication, takes up very little floor space, and has no valves to require examination or renewals.—*Engineering.*

SIR WILLIAM WHITE ON MARINE PROPULSION.—Personally, remarked Sir William, he had long held and expressed the opinion that there was a great field for the use of internal combustion engines in ship propulsion, especially in vessels of moderate dimensions or moderate engine power. On the other hand, as a diligent student of information made available to engineers and naval architects, he had been convinced that, up to date, there continued to be very serious difficulties in the way of constructing oil or gas engines which should develop great power in individual cylinders. It was well known that experiments in that direction were in progress, and it might be admitted that difficulties of this nature existed only to be attacked, and if possible, to be overcome by engineers. On the other hand, it could not be denied that these difficulties had not yet been overcome, and

that engineers responsible for the design and construction of marine engines of the new types had hitherto found it safer to use comparatively small cylinders, and a large number of such cylinders in order to reach the very moderate aggregate power as yet applied in sea-going motor-driven vessels.

No one could have visited the *Selandia* or *Jutlandia*, continues Sir William, without being impressed by the multiplicity of cylinders and valve gear for a total development of 2500 horse-power especially when one remembers what such multiplicity involves during continuous running over long distances. Every one familiar with turbine-driven vessels of very great power would have been struck with the great contrast between their engine rooms and that of the *Selandia*. Engineers who had been in charge of steam turbines would not be eager to return to reciprocating engines whether they were actuated by steam or oil.

The Practical Advantages of a Rotary Engine were undeniable as well as considerable. If these advantages could be retained in association with equal or less fuel costs and no less freight-earning capacity than were attainable with internal combustion reciprocating engines—and the facts stated by Sir Charles Parsons and Mr. Walker in regard to the use of geared turbines seemed to establish that possibility—it was reasonable to anticipate that the oil engine would not have such a "walk over" in the contest with steam engines as popular journalists—not practical engineers—had predicted. One thing was certain: shipowners would be guided by commercial considerations rather than by sentimental; and they would not be desirous of accepting avoidable risks. It was a matter for congratulation, therefore, that the first experiments with new, and necessarily rival, systems of propulsion should be made on a moderate scale. Experience with cargo steamers already in service, or about to be employed, would settle many questions on which, at present, there was room for difference of opinion, and would lead to further advance in those directions which proved to be most promising.

Impracticability of Singular Solution.—One prediction might be made confidently; the complex and varied problems of marine engineering did not permit of any one or singular solution being found; no system of machinery could prove to be the best for all cases which occurred in practice; sudden or sweeping changes such as had been declared to be imminent of late were impossible. This discussion would have served a useful purpose in making clear both the present position of affairs and the directions in which advances would be made in the immediate future.—*Page's Weekly.*

PROPULSION FOR WARSHIPS.—As might be expected, each method of propulsion thus far tried has difficulties and objections peculiar to it, but steady progress is being made, and probably it will not be long before a satisfactory solution will be evolved. It appears to me that at present for vessels carrying the whole or a large proportion of their fuel supply in the form of oil, as do our most recent battleships, the ideal solution would be to fit Diesel engines or the equivalent, driving generators, which in turn drive motors upon the shafts; this installation, however, to be of low power, adapted to drive the ship about ten knots only. For higher speeds turbines and boilers would be relied upon.

Such an arrangement would be slightly heavy as regards weight, but would have the advantage that the endurance would be doubled at cruising speed, and an entirely independent means of propulsion would be provided, giving reasonable insurance against breakdowns. It would also be a step towards the generally anticipated use of the oil engine only for propulsion.

Such an installation would involve some difficult engineering problems, but I know of no reason why they could not be satisfactorily solved.—Naval Constructor D. W. Taylor, U. S. N., in "Recent Advances in the Art of Battleship Design," in the Journal of the Franklin Institute.

RADIO.

The Marconi Wireless Co. will soon start the construction of the two largest wireless stations in the world in San Francisco. The company's plants include an immense system of wireless stations, reaching across the Pacific from San Francisco to the Philippines, with high-power transmitting stations at Honolulu and on the coast of China. This means that the Marconi wireless system will enter into active competition with the Pacific Cable. It is also announced that the Marconi Co. will install a 500-kilowatt station at Panama. When the stations in San Francisco and the one in Manila are completed, direct communication between these points, a distance of 6962 miles, can be sustained without interruption. With the high-power wireless stations at San Francisco, Honolulu, China, Manila and Panama, any ship in the most remote part of the Pacific may possibly be reached almost instantly.—*Shipping*, Illustrated.

WIRELESS TELEGRAPHY IN PERU.—Wireless communication has been established between Lima and Iquitos, across a vast stretch of the Andes, without the use of intermediate stations.

Radio messages were sent from an aeroplane by Lieut. B. D. Foulois, U. S. A., to the Aviation School at College Park, Md., on August 6, 1912, a distance of twelve miles. The sending key was attached to a lever and worked satisfactorily. This is the first really successful use of radio from aeroplanes.

WIRELESS BILL BECOMES LAW.—Congress recently passed a bill requiring any United States or foreign vessel navigating the ocean or the Great Lakes and carrying fifty or more persons to be equipped with wireless apparatus capable of operating for a distance of at least 100 miles by day or night, on and after October 1, 1912. An auxiliary or emergency energy supply is required capable of operating the sending set for at least four hours. The wireless equipment must be in charge of two or more skilled operators, one of whom shall be on duty at all times. The bill does not apply, however, to vessels plying between ports less than 200 miles apart.

On July 23 President Taft affixed his signature to this bill and it thus becomes a law. So far as the act relates to the Great Lakes it takes effect on and after April 1, 1913, and in respect to ocean cargo steamers it becomes effective on and after July 1, 1913. Provision is made that on cargo steamers the second operator may be replaced by a member of the crew who is competent to understand and receive distress calls and assist in maintaining a constant wireless watch so far as needed for the safety of life.—*Electrical World*.

PROCEEDINGS OF THE LONDON WIRELESS CONFERENCE.—The International Wireless Telegraph Conference which convened in London on June 4, was formally adjourned on July 5. The conference revised the regulations governing the exchange of messages between ships and shore. The new convention and the revised regulations were signed by the delegates of all the countries represented—about thirty in number. The conference gave special consideration to the use of wireless communication for the relief of disasters at sea, and, after full discussion, unanimously adopted a resolution for compulsory wireless equipment on shipboard, the text of which is as follows:

"The International Radiotelegraphic Conference, having examined the measures to be taken with the view of preventing disasters at sea and of rendering assistance in such cases, expresses the opinion that, in the general interests of navigation, there should be imposed on certain classes of ships the obligation to carry a radiotelegraphic installation.

"As the conference has no power to impose this obligation it expresses the wish that the measures necessary to this end should be instituted by the governments.

"The conference finds it important, moreover, to insure, as far as possible, uniformity in the arrangements to be adopted in the various countries to impose this obligation, and suggests to the governments the desirability of an agreement between themselves with a view to the adoption of a uniform base for legislation.

"Lastly, the conference recommends to the governments the desirability of establishing in each maritime country a number of coast stations with a permament service adequate for the needs of navigation."

The new regulations contain a number of provisions designed to increase the effectiveness of wireless communication at sea in cases of emergency or danger. Ships in the future will be required to provide an auxiliary or independent source of energy capable of working the wireless apparatus for at least six hours. The emergency installation must be located in a secure position on shipboard and must be so completely independent that any accident to the ship's engines will not interrupt the energy supply for wireless communication. On ships of the first class a permanent watch will be required and at least two fully qualified operators must be carried. On ships of the second class, where a permanent watch is not considered feasible, the operator will be required to listen during the first ten minutes of every hour. In the smallest ships, such as fishing boats, no regular periods of watch have been prescribed. Each government in issuing licenses to carry wireless equipment will determine in which class any vessel belongs.

Rules have also been made requiring both ship and shore stations to suspend work and listen at the end of each quarter of an hour in cases where it is likely that distress calls otherwise might not be heard. In order to prevent future confusion a ship in distress will have control over the working of all stations in its vicinity and operators on every ship will be placed specifically under the authority of the captain. The transmission of weather reports to vessels at sea will be given priority and coast stations will be supplied with weather forecasts for communication to ships when called for.

At the Berlin conference regulations were adopted requiring ships to communicate with the nearest shore station, as a means of preventing confusion in working. Numerous proposals were advanced for modifying these regulations so as to allow communication between a ship and some remote shore station. After discussion a new regulation was adopted which permits such communication when a special wave-length of specified dimensions is employed; but this provision applies only to communications between a ship and a shore station of the same nationality. Since the transmission of radiotelegrams between ship and shore by means of one or more intermediate ships is becoming more frequent, the convention adopted regulations in reference to charges, accounting, etc., for facilitating this service.

All the countries concerned have now agreed that all ships should be under the obligation of communicating upon call with one another regardless of the wireless system employed. The convention decided that it is premature to attempt to prescribe regulations affecting long-distance service between land stations, and it was expressly agreed that each country ought to remain free to organize such land service as it deems necessary, subject only to the restriction that interference between different stations must be avoided as far as possible and that differences in the system of wireless telegraphy employed must not be a basis for refusing intercommunication. The American delegates conveyed to the convention an informal invitation to hold the next conference in Washington, D. C. This invitation was unanimously accepted, and the date of the next conference was fixed for 1917.—*Electrical World.*

AERONAUTICS.

AVIATION. A SHORT DESCRIPTION OF THE PRINCIPLES OF HEAVIER THAN AIR MACHINES.—Leaving aside Icarus and Phæton, and other mythological heroes, and the well-meaning cranks of the early nineteenth century, the first man who proved of any real use to modern aviation was the wonderful

Lilienthal. He pursued his remarkably accurate investigations on the effect of the resistance of the air against a moving curved surface, or rather a moving curved inclined plane, if we use plane in the sense of plane in aeroplane. But besides these investigations, absolutely essential to the designing on a aeroplane, he successfully launched himself from the tops of hills and mounds into the air against the wind in what are called gliders, that is, aeroplanes without engines, making over two thousand flights, and of course giving to the whole world the benefit of his experiences. He was killed by falling only 50 feet in 1896, just as he had started to fit an engine of 2½ horse-power, which just managed to flap its wings, but at the same time considerably extended his flights. Pilcher, an Englishman, was killed in the same way. Langley, an American, was another great pioneer; his investigations on the resistance of the air were almost perfect, but only concerned the flat inclined plane, and this was soon discovered to be more or less useless for an aeroplane.

Langley eventually evolved a machine called an aerodrome; the models were very successful; he received a grant of $50,000 from Congress, but the man-carrying apparatus failed by a mischance, and he died shortly afterwards of a broken heart.

Chanute was the predecessor of the Wrights, and built a machine practically the same as theirs, and the prototype of the present biplane. He started gliding experiments, which were carried on and perfected by the Wrights.

Sir Isaac Newton was the first to usefully investigate the resistance of the air against moving surfaces, and he worked out the universal and well-known law that the resistance is proportional to the area of the surface and the square of the velocity.

At first we will assume that we have a simple plane proceeding at a given speed, say 60 miles an hour, and inclined at an angle of incidence of 50°, we should also choose a curvature of about $\frac{1}{12}$, all these assumed dimensions being those found practically best. Now as the air strikes the plane more or less at right angles to its chord, it can be resolved into two forces at right angles to each other; the horizontal one tries to counteract the thrust of the propeller, and the vertical one expends itself in lifting the plane. The horizontal force is called the drift, and the vertical one the lift. In working out these problems the lift must always equal the maximum weight of the machine, and this will enable the machine to just fly, and providing the velocity can be increased by means of a more powerful engine, the machine will climb. From intricate formulæ for inclined curved surfaces we find the necessary area of the surfaces, say 216 square feet, and we decide on a monoplane of a span of 36 feet, and a depth of 6 feet, a good proportion. We now know that if we fit on an engine to this of enough power (provided the total weight does not exceed the lift), and turn it on, it is bound to rise in the air.

There are, however, two other main factors remaining for safe and practicable flight, even in a straight line, and up to date we have not considered anything other than a straight flight. These two factors are longitudinal and lateral stability. First consider longitudinal stability; we have this single plane curved $\frac{1}{12}$, width 6 feet, gradually rising owing to the pressure of the air acting against the curved surface. This pressure may be considered to act at one point, the Center of Pressure, in the same way as the weight of an object acts at one point, called the center of gravity. The position of the center of pressure depends upon the angle of incidence of the plane to the air current, and of course this is liable to alter during flight. Allowing that in the simplest form of machine, as the simple plane in consideration, the center of pressure coincides with the center of gravity, though it need not necessarily; any alteration in the position of the center of pressure would immediately cause instability, the lift working, say, too near the front; the plane would then turn over and of course capsize; to counteract this a tail is put on at a good distance from the front—roughly

the total overall length is equal to the span—and another similar inclined plane of a small size is attached to the end of this tail. Of course there is a similar lift acting on this plane at its center of pressure, and by means of a lever operated by the pilot, any alteration of the center of pressure in the main plane can be balanced by altering the center of pressure at the tail. The tail acts as a lever, and the small lift at the tail does sufficient work, being at a greater distance. This small surface at the tail is usually called the elevator, as by its means the aeroplane is lowered or raised at the operator's desire during flight, although its main object has already been described.

Nearly all monoplanes have only a tail elevator, but the Bregnet, Avro, Goupy biplanes are also of this type. The tendency is to do away with a front elevator. The front elevator is a familiar object in the Wright, Farman, Bristol, and nearly all of the early biplanes, where the center of gravity is in front of the center of pressure. The Valkyrie is about the only successful monoplane with a front elevator.

The most baffling problem of the early days of aviation was that of lateral stability. The Wrights deserve practically the whole credit for discovering the means of ensuring this, and it is their only important patent.

They placed movable wing flaps or ailerons at the ends of the planes, and in flight of course these hung out straight in line with the rest of the surface. If the aeroplane tilted to the right, all that was necessary was to pull down the right ailerons, the right wing then catches, as it were, more wind pressure, and rises again. At the same time the left ailerons are raised and less pressure is experienced on the left wing. The other method, perhaps in more general use in nearly all monoplanes, such as the Bleriot, Morane, R. E. P., and some biplanes such as the Bregnet, is warping, *i. e.*, actually pulling up and down the wing tips, which are otherwise more or less rigid.

The only other essential detail is the means of directing, and this is very simple. It is done by means of one or more vertical rudders placed nearly always at the tail, and worked in exactly the same way as the rudder of a boat.

The arrangement of the controls is very varied in the different types, but is often as follows:

The direction rudder is worked by the feet in the same way as a tiller, the elevator is controlled by a lever which actuates it, if moved from front to rear. This lever is on a universal joint, and if moved sideways actuates the ailerons or warps the wing tips. In the latter case, at the end of the lever is a steering wheel as in a motor car and warping is done by turning the wheel, and elevating by pulling it to the rear, and depressing by pushing it forward.

It is often necessary to do these three things together, the three dimensions of the air, of course, bothering the absolute novice not a little. The propeller works exactly as the screw of a steamer. It can be placed in front or behind the main planes. If in front it is usually called a tractor screw. Great difficulty has been experienced in getting the best form of aerial propellor to do the most efficient work, and our knowledge of the subject is at present very small.

The biplane has a much bigger lift than a monoplane, and can consequently carry more weight. Although up to a certain extent by increasing the span of the monoplane large weights can also be carried. The biplane with a monoplane tail is rightly coming into fashion.

Of the various motors the Gnome rotary engine has been found to be the most reliable up to date. However, there are many disadvantages in a rotary engine, and there seems plenty of opportunities of perfecting the stationary engine of which there are many excellent ones such as the Renault, R. E. P., and Canton Unué, of foreign make, and the E. N. V. and Green which we produce at home.—From an article by Lieut. T. H. Sebag-Montefiore, R. F. A., appearing in *The Journal of the Royal Artillery*.

SCOTT PROJECTILE DROPPING DEVICE.—The bombs weigh 18 pounds and are released in pairs. In setting the sight the altitude, forward speed, and weight and shape of projectile are considered, and are worked out so well that in March, 1912, in France, Mr. R. E. Scott, late first lieutenant, U. S. Coast Artillery, obtained these results:

Target was 65 feet in diameter.

From a height of 650 feet the projectiles fell to within 4.9 feet and 6.5 feet of the center of target.

From heights above 3280 feet, the projectiles fell out of the target, but were in line with its center.—*Aero Club of American Bulletin.*

BOMB DROPPING IN FRANCE.—The French officers are experimenting with dropping bombs from aeroplanes, and find that this is more difficult than may be at first supposed. The object is to drop bombs of 15 pounds weight from a height of 600 feet and to place them in a target of 60 feet diameter. Lieut. Mailfert piloted the aeroplane on one occasion, with Capt. Conade attending to the bombs. Another aeroplane was piloted by Lieut. Bousquet who also operated the dropping device placed under his seat. The weather was somewhat rough, and they found that a slight wind gust was enough to send the bomb off the target. For instance, Lieut. Mailfert, who according to the regulations was obliged to drop 15 bombs in 50 minutes, took 38 minutes 11 seconds to pass 15 times over the target at 600 to 750 feet height, but he rarely succeeded in placing the bombs in the target, this being only two or three times. From this it will be seen that the matter will require considerable practice, but as these are among the first experiments there is no doubt that the future will see much closer work.—*Scientific American.*

HYDRO-AEROPLANES.—As fresh experience is obtained with the use of aeroplanes it is seen that their scope for military purposes is much more restricted than had been expected. The "fifth arm," as the aeroplane is called in France, will, of course, render invaluable service for scouting work, but it has so far proved a failure as a fighting machine. Imagination at first ran riot with the aeroplane, which was to become a deadly arm of attack by dropping explosives on a helpless enemy, but it is found to be far from an easy matter to drop explosives at a required point with any chance of doing execution. To be safe from shots and shells the machine must fly at a height of at least 800 m., and it is obviously impossible to drop explosives on small masses of troops, except by accident when the aeroplane is flying at such a height at a necessarily great speed. For the moment, therefore, the aeroplane is regarded solely as an instrument for reconnoitring, and, as nothing further can be done, interest is being centered specially in the machine adapted for taking its flight from water. Experiments with hydro-aeroplanes can be carried out much more safely than with aeroplanes, and the conditions of flight being much the same the hydro-aeroplane will be developed with a view, at the same time, of improving the aeroplane. So far it must be admitted that the toll of lives has been much too heavy for the small progress made with the aeroplane during the past year.—Editorial in *The Engineer.*

TWO-POWER UNITS FOR AEROPLANES.—The navy has just taken over a new triple tractor propeller twin engine hydro-aeroplane made by Messrs. Short Brothers, to fulfil certain requirements laid down by the Admiralty. The power consists of two revolving seven-cylinder Gnome engines, each of 50 horse-power, the weight of the machine being 1800 pounds, yet its efficiency is such that at need it can continue flying with only one motor working. Tried for speed with both engines, the aeroplane did 62 miles an hour; she can carry four people, with petrol and oil, for seven hours. Her over-all length is 38 feet, and the maximum span from one extremity to the other of the upper wing, which is larger than the under one, is 50 feet, the gap between the two planes being 7 feet. The central propeller is

driven direct from the engine, and the two side by side screws immediately in front of the main planes are driven by chains. All flying wires are doubled, and the factor of safety all round is ten. The pilot has an unusually clear view ahead of him. The floats, or pontoons, each weigh 214 pounds. The vessel is designed to stand buffeting about in an eight-foot sea-way, and that she will do so easily may be judged from the fact that the other day, with an earlier and smaller Short-built monoplane, having only one motor, which temporarily failed, Commander Samson, R. N., drifted approximately 34 miles while the wind was blowing from 25 to 30 miles an hour. Having no telegraphic apparatus on board he was 5½ hours before being picked up, yet the little machine was no worse for the enforced trial. It is occurrences of this kind, however, which have determined the Admiralty policy of having no more aeroplanes with single power units, but only those with two or more motors, so that if one goes wrong at least some proportion of motor power is always available.—*United Service Gazette.*

THE AVIATORS' LIFE PRESERVER.—The provision of a practical life-saving apparatus would come as a great boon and encouragement to the aviation science. The dangers of aerial service, though fearlessly met by our officers and men, should be guarded against in every possible way. We believe that there is such a valuable adjunct to the flying machine, and that it is the outcome of the study of a former Russian artillery officer named Kotebinkoff. Its main idea is as follows: a box containing the parachute is strapped on to the shoulders of the aviator, and is connected with the aeroplane or other flying machine by a string which snaps under a slight tension, thus opening the box automatically and releasing the parachute which springs into the air and inflates or gathers its power. The total weight is reported to be only 18 pounds. The parachute is made of strong wefted silk and its area when extended covers 50 square meters. In conducting the experiments with this apparatus, life-size dummies were dropped out in varying positions, head first and otherwise, and it is reported that in all cases a drop of fifty or sixty feet was sufficient to extend the life-saving apparatus and reduce the rate of descent to 1.60 meters per second. It seems to us that if a clearance from the disabled or falling air machine can be assured, this invention is one that deserves the closest scrutiny by our aeronautical experts.—*United Service Gazette.*

MILITARY USE OF AEROPLANES.—Capt. Sykes gave some interesting details of the employment of aeroplanes in the operations of Tripoli. The salient lesson learned by the Italians was the unsatisfactory and inconclusive results obtained from dropping bombs, an operation which at present involved even greater danger to the pilot than to the enemy.

Col. Holden said that during the German maneuvers last year extensive experiments were made in reconnoitring from dirigibles. The most interesting result was to establish the fact that bodies of troops and guns could be simulated with the greatest ease by simply turning up the earth to the required shape. In these conditions it was impossible for the airman to distinguish between the false and the true.

Col. Seely emphasized the immense importance of variable speed and of automatic stability. Speaking in the same hall a few months ago, Prince Louis of Battenberg had pointed out that the navy needed hawks, web-footed hawks, able to hover over land and sea. But the hawk possessed one quality that the aeroplane lacked—it was able to hover. Let them produce an aeroplane that could hover, perfectly silent, invisible, transmitting its news by wireless, and the whole of warfare would be revolutionized. We must be the foremost nation in the air, as we already were on the sea, but in striving for this object valuable lives must not be sacrificed.—*The Army and Navy Gazette.*

Great Britain has formed its military aviators into a corps, called the Royal Flying Corps. Entry to it will be ultimately confined to officers who have

graduated at the Central Flying School. Those officers will be drawn from all branches of the naval and military services and civilians. The rank and file will consist of warrant officers, petty officers, non-commissioned and men transferred from the navy or army and also of men enlisted directly into the Royal Flying Corps. After graduating at the Central Flying School officers will be attached, as may be necessary, to the naval or military wing for further training. The period of appointment in the case of officers who elect for continuous service with the naval or military wings of the Royal Flying Corps will normally be four years. The period of enlistment of enlisted men is four years, with re-engagement from year to year. A primary condition is that in time of war every member of the Royal Flying Corps shall feel obligated to serve in any part of the world. The corps will have a reserve divided into two classes, the first and second reserve. To belong to the former class it will be necessary to perform a certain number of flights, but in the second class no flights are requisite. The Royal Flying Corps will be maintained jointly by the War Office and the Admiralty. It is proposed that a permament consultative committee be appointed, to which questions in connection with flying shall be referred by the Admiralty and War Office. The Central Flying School will be established on Salisbury Plain. The naval wing of the corps will be for the present at Eastchurch, the site of the Naval Flying School. The corps does not comprise aviation alone, but embraces all forms of aeronautics, including kites. Until now it was the plan of the War Office to train only officers as fliers, but the scope of instruction will be widened to include non-commissioned. It is considered that the minimum number of trained fliers should be two per aeroplane. For seven aeroplane squadrons the following would be the division of the personnel: Commanders, seven officers, no non-commissioned; sergeants, seven; three sections, 84 officers, 84 non-commissioned; total officers, 91; total non-commissioned, 91. The reserve would be of the same number, so that 182 would be the combined total for officers and non-commissioned each. The old air battalion disappears by this new arrangement, being absorbed into the Royal Flying Corps. Great importance is attached to cross-country flying as part of the instruction of the corps, and arrangements will be made with private aerodromes for that purpose. To study better weather conditions in the upper air a meteorological expert is to be attached to the Central Flying Station. The above is the purport of a long memorandum recently issued by the British War Office as a Parliamentary paper.

THE NAVAL AVIATION SCHOOL.—The Admiralty have purchased 10 acres of land, adjoining the Royal Aero Club's Aviation Grounds, Eastchurch, Sheppey, for the purposes of the newly formed Naval School of Aviation. Buildings, including officers' quarters, barrack accommodation for men, workshops, and sheds (which will be of a temporary character) are to be begun at an early date.—*Army and Navy Gazette.*

M. CROMBEZ' REMARKABLE OVER-SEA FLIGHT.—Recently M. Crombez, the Belgian airman, flew from Nieuport, in Belgium, to Calais, thence to Dover, and back to Nieuport without a stop, covering the whole return journey of 150 miles in 140 minutes. Nothing previously accomplished approaches this sensational feat in the significance of the impression it conveys to the average mind as regards the future possibilities of the flying machine; whilst the importance which will be attached to it by those who look at aviation solely from the military point of view can be readily understood. It should be mentioned that the machine used by M. Crombez was a Deperdussin monoplane, a type of aeroplane which is now right in the front rank for speed, reliability, and all-around efficiency.—*Army and Navy Gazette.*

A practical example of the use of hydro-flying machines for communicating with the fleet in the open sea near home ports was shown in the Bay of Spezzia recently. The new Italian *Dreadnought, Dante Alighieri,* left the

arsenal at 8 a. m. for her preliminary trials, which, it is reported, gave results considerably above the estimates. An hour later Captain Guidoni followed on his "idro-volant," and, after rounding Palmaria Island against a brisk wind, overtook the battleship, which was then going full speed for Portofino, circled round her several times, lowered his course to within a few meters of the bridge, saluted Admiral Patris, and returned to Spezzia, having flown 50 kilometers in 40 minutes.—*The Engineer.*

The experiments at Spezia with the Guidoni hydro-flying machine, referred to above were continued, and gave rise to some incidents of technical interest, as, for instance, the conveyance of a passenger at 50 m. altitude twice round the wide bay on a machine not in reality built for carrying extra weight, and the accident which was nearly the cause of the loss of the apparatus and its inventor. The *Dante Alighieri* had left in the morning for her final official speed trials, and having performed the run to Genoa, was returning at full steam, when the "hydro-volant" left Spezia, and, after joining the battleship near Cape Noli, accompanied her on her course, circling round her continually, as on the former occasion, till opposite Serravezza. At this point the machine suddenly gave a violent lurch, grazed the sea with the point of one wing, seemed to shake itself free for a moment, and then fell on its side. The accident, which was rendered a mere episode by the prompt salvage of both Captain Guidoni and his apparatus, was probably caused by the suction of the air produced by the passage of the *Dante*, then travelling at 24.5 knots through the water.—*The Engineer.*

REQUIREMENTS FOR NAVAL AEROPLANES.—They are required to carry, as a full load, two persons of a combined weight of 350 pounds, together with a wireless outfit and other instruments and supplies for a 4-hour flight. A maximum speed of 55 miles per hour must be shown as an average of ten flights—five with the wind and five against it—over a mile course, and 50 miles per hour throughout the 4-hour endurance test with full load. The latter test will be made over a 5-mile triangular course, the speed being determined by a recording anemometer. All machines must rise from the water in still air, with a run of not over 1000 feet; must climb to 1500 feet in one or more big spirals and in a given time (not yet determined), must turn without skidding, stalling or sliding, in a circle of 200 yards radius, and must glide from a height of 500 feet with power off a distance of 2500 feet in a horizontal direction. Air-cooled motors are preferred and an extra premium will probably be offered for a heavy oil motor or one using kerosene or alcohol. It must be arranged to be started from the seat by the pilot. The machines must be able to be hoisted on board ship intact and to be quickly disassembled. The hydroplane floats must have watertight compartments and means of draining readily. The aeroplane must be able to remain upright on the surface of the sea in a 20-mile wind when the motor is stopped.—*Scientific American.*

The war biplane built by the Wright Brothers for the Signal Corps has been tested at College Park, Md. One of the conditions is that the biplane shall fly not less than forty-five miles an hour, with 450 pounds on board, not including gasoline, oil and water, for four hours. In a test on May 21 it made an average of fifty-two and four-fifths miles an hour. The second test consisted in climbing 2000 feet with the same load in ten minutes, but in this the biplane failed on account of a stiff wind.

WHY AIRMEN ARE KILLED.—Major Roche, of the French Army, is responsible for the statement that 25 per cent of the accidents sustained by aviators are due to lack of natural aptitude, 25 per cent to poor construction of the aeroplanes, 13 per cent to insufficient training of the pilots, 13 per cent to a total misconception of the limitations of the aeroplane, from 10 to 12 per cent to atmospheric conditions, over which the aviator has no

control, and 6 per cent to sheer recklessness of aviators who go up without testing their machines or land on unfamiliar ground.—*Scientific American.*

MISCELLANEOUS.

THE LARGEST WARSHIP.—Although authorities differ as to the dimensions of the recently launched British battle-cruiser *Queen Mary*, there seems little reason to doubt that she is the largest warship afloat at the present time. Some authorities give her dimensions as follows: Length over all, 725 feet; beam, 87 feet; and displacement, 29,000 tons. She will probably make over 30 knots on trial, and to do this her turbines will have to develop not far short of 100,000 horse-power. The *Moltke*, of 23,500 tons approximate displacement, required 90,000 horse-power to drive her at from 29 to 29½ knots.—*Scientific American.*

PRECAUTIONS AGAINST COAL-BUNKER FIRES.—Research and investigation have now proven beyond all question: 1. That all coal gives off inflammable gas when freshly worked, and also when freshly broken, and that this gas becomes explosive when mixed with certain proportions of air. It is the evolution of this gas which requires the ventilation of the bunkers before entering them with naked light.

2. That heating of coal and the consequent risk of spontaneous combustion does not proceed from the presence of gas, but is caused by the absorption of oxygen from the air.

3. That this absorption, and the accompanying development of heat, is greater at high than at low temperatures, so that when once commenced it proceeds at an increasing rate if the supply of air is maintained.

4. That where heat is being generated by the absorption of oxygen it is probable that more gas will be evolved. The evolution of the gas, however, does not cause the generation of heat. Where such gas is being evolved, if sufficient supply of air is maintained to provide more oxygen than is being absorbed, an explosive mixture is formed amongst the coal.

5. To minimize the absorption of oxygen by the coal in reserve bunkers, or in any bunker in which men are not actually working, the lower doors should be kept absolutely closed, so as to prevent any current of air whatever passing through the bunker and into the mass of coals.

6. If there are any parts of bunkers in which, owing to the proximity of boilers, uptakes, or recesses through which steam pipes, etc., are carried, there is likely to be a higher than normal temperature, these parts should, if possible, be stowed with large coal, and should be worked out as soon as possible. The shoots should be arranged not to deliver small coal into these places.

7. Small coal, which accumulates under shoots, etc., should be worked out as soon as possible, and not left till the last.

8. If any coal is left in a bunker when a fresh charge has to be taken in, it should be trimmed into a position to ensure its being used on the next voyage. It cannot be too strongly impressed upon those responsible, that danger of overheating and spontaneous combustion increases with the length of time the coal remains in the ship.

9. Where bunkers are over gutterways, etc., special care should be taken that the limbers are tight. Several fires have originated in bunkers just over the limbers, and there is reason to suppose that they have been caused by air circulating through the coal and coming from the limbers.

10. There is no risk entailed by the coal being wet when put on board. In fact, in cases where coal is known to be of a fiery nature, it would be of an advantage for the small coal to be damped when charging the bunkers.

11. If heating of any part should occur where there is no traceable external source of heat to account for it, the heating will probably be local only in a part where the coal is small, and the surrounding portions may not be overheated. In attempting to obtain access to the heated parts for the purpose of applying water, special care is needed to prevent the action

taken from supplying the air which is needed to convert a heated zone into an actual fire.

12. Although some kinds of coal have proved to be more liable to spontaneous heating and combustion than others, it should be realized that all coal, even anthracite, is liable to these occurrences.—Extracts from report of the Chief Engineer Surveyor of Lloyds on Spontaneous Combustion of Coal, 1912.

THE BAGHDAD RAILWAY.—It is announced that Koweit will not be the terminus of the Baghdad Railway, and that the section, Baghdad-Basra, is to be proceeded with. Great Britain does not desire to obstruct its construction, nor has she ever done so. What we must prevent, at all costs, is the seizure of Koweit by the Turks, who have twice attempted to rob Sheikh Mubarak of his city. Once the Turks get inside Koweit's walls they can back up the *coup-de-main* with such military force from the Baghdad and Damascus Army Corps that the whole British Army in India could not take it again. Ships cannot sail over deserts, or even far enough up the Shât-el-Aràb to hurt a Turkish Army in the hinterland of Koweit. With this town in Turkish, or possibly unfriendly, hands, our prestige in the East would be gone. If the Baghdad Railway stops at Basra this danger is eliminated.—*The Army and Navy Gazette.*

CAPE COD CANAL PROGRESS.—When the delegates of the recent International Navigation Congress visited Cape Cod they were assured that this work would be opened to traffic during the winter of 1913, or at the latest in the spring of 1914. The canal will provide a 25-foot depth from Barnstable Bay to the 30-foot depth in Buzzards Bay, a distance of 12½ miles. The minimum width on the bottom will be 200 feet. The canal will enable ships to avoid the dangers of the stormy outside passage around Cape Cod, and it will shorten the distance from Boston for ships passing through Long Island Sound by 66 miles. Fifty thousand vessels of a total tonnage of 25,000,000 and carrying 500,000 passengers pass around Cape Cod every year, and the majority of this traffic, it is expected, will seek the shorter and more sheltered route.—*Scientific American.*

THE KAISER WILHELM CANAL.—Extract from a paper by Herr H. W. Schultz of Kiel.—The canal was cut during the years 1886 to 1895. The present canal, which was 61½ miles in length, had a breadth at bottom of 72 feet 3 inches and a depth of water of 29 feet 6 inches over a stretch of 41.25 miles from the Kiel end, increasing to 33 feet 9 inches at the North Sea end at Brunsbüttel. The water level corresponded with the mean level of the Baltic. The smallest section was 4445½ square feet. The breadth was increased at the bends by amounts varying from 0 for radii of 3000 m. to 52 feet 6 inches for radii of 1000 m. Lake Audorf, to the east of Rendsburg, served as a turning place.

At each of its ends the canal had two locks, which were opened only when vessels were to be passed through. The Brunsbüttel locks were used for draining the canal, and this rendered the extra depth at this end necessary. The locks were a necessity on account of the rise and fall of the sea level at each end of the canal. The level of the Elbe had reached a height of 17 feet 3 inches, and that of the Baltic a height of 10 feet 4 inches above the mean level of the canal. The canal was intended to accommodate vessels of maximum dimensions, 475 feet 9 inches by 75 feet 6 inches by 27 feet 10½ inches. The locks for these latter had available lengths of 492 feet 1 inch, widths of 82 feet, and depths on sill of 31 feet 5 inches in Holtenau and 32 feet 9 inches in Brunsbüttel. The locks could be used whether the level of the water outside were high or low.

The canal was crossed by two railway and road bridges, one at Grünental and one at Levensau, with arches of 137 feet 9½ inches in height above the water level, a one-armed railway swing bridge at Taterpfahl, two bridges of the latter kind at Rendsburg, a road swing-bridge also at Rendsburg,

and a pontoon swing-bridge for road traffic in Holtenau. The four swing-bridges at Taterpfahl and Rendsburg each had a clear width of 164 feet, and were operated hydraulically.

The canal served as main drain for a large part of the country crossed by it, the water flowing through the Brunsbüttel locks, which accordingly were opened to the Elbe at the ebb. The whole line of the canal was electrically lighted with incandescent lamps of 25 candle-power.

The canal employed 120 pilots and a number of assistant pilots, whose services were given to vessels at one-quarter of the net cost occasioned. A number of pilots undertook work on their own account. Pilotage of steamers and towage of sailing vessels were compulsory.

In 1910, 45,569 vessels of 7,580,000 net tons paid toll. Since 1896 the numbers had increased by 182 per cent, and the tonnage by 310 per cent. Most of the vessels were of small dimensions. The receipts had for the last few years somewhat exceeded the expenses.

The widening was rendered necessary by the increase in the sizes of war vessels. The alterations were to be made without hindrance to the traffic. The present locks could not be interfered with, and new ones had to be constructed of such a size that they would suffice even for future further enlargements of the canal. The new section was, in general, to have a breadth at bottom of 144 feet 5 inches, and a depth below ordinary water level of 36 feet. The area of section was thus practically doubled, and the surface breadth was increased from 216 feet 6 inches to 334 feet 8 inches. The widened canal would have ten two-sided sidings of from 656 to 1200 yards in length, and one one-sided one 1530 yards in length. The ordinary sidings had a bottom width of 219 feet 9 inches, and the one-sided ones a width of 292 feet. The four 1100 m. sidings, arranged as turning places, had bottom widths of 538 feet, the turning place itself in each case having a diameter of 984 feet. The quantity of ground to be removed, amounting to about 130 cubic yards, was considerably greater than that dealt with at the original canal construction.

The new locks had lengths of 1083 feet, clear widths of 147 feet 7½ inches, and depths over sill of 45 feet 2 inches at mean water level, and 40 feet 9 inches at low water in the Elbe. A reason for the great depth given to the locks was that they were thus enabled to take in damaged vessels. These new locks would be the largest in the world. The swing-bridges at Taterpfahl and Rendsburg and the pontoon swing-bridges at Holtenau had to be replaced by lofty new iron bridges, and the road swing-bridge at Rendsburg by a new one of greater span. The total cost of the widening operations had been estimated at about $55,000,000.—*The Engineer.*

OILER OR STEAMER?—German naval publications advocate the use of the term *oiler*, for vessels that have oil fuel. We have the terms steamer, steamship and the verb to steam, from the fact that steam is used in those ships. If adopted we would designate the steamer America as the oiler America if oil fuel is used, and, as some object to the use of the verb *to sail* and prefer to state the vessel *steamed for*, we would then use the verb *to oil*, and state that the *oiler America oiled* for such a port.—*Marine Rundschau*, by W. H. B.

ACCIDENTS DUE TO MILITARY CAUSES.—In the years 1909, 1910 and 1911 there were 103 such accidents, and they caused the death of 341 men and wounding of more than 510. The accidents seems equally divided during the years, and are as follows:

	Accidents.	Killed.	Wounded.
France	24	223	201
Japan	5	39	82
United States	13	20	16
Germany	12	15	35
England	9	..	..

Twenty-five accidents occurred during target practice on board ships, and 25 ashore. Seventeen took place when assembling ammunition.

Five guns were destroyed by the bursting of shells in the bore. Thirteen accidents were caused by improperly designed breech mechanisms, and four by accidental ignition of charges of powder.

Twenty-six accidents are due to imprudence, and 49 accidents are due to faults of matériel, amongst the latter the four most serious ones are those caused by spontaneous combustion of powders, amongst this last, four large war vessels, the *Aquidaban, Iena, Matshushima,* and *Liberté.* For 26 accidents the exact cause is unknown.—*Internationale Revue.*

LOSSES OF THE JAPANESE IN THE RUSSIAN WAR.—The official statistics of the Japanese Surgeon-General Mori allow us to at least see exactly the losses of Japan in killed and wounded during the war in the Far East in 1904-1905. These figures in no way agree with those given in the most important histories of that war. According to these exact statistics the total loss was 40,374 killed, and 134,221 wounded, being in all 174,595 men, of which at Mukden, alone, 70,059 men (16,404 killed and 53,655 wounded); at Port Arthur 43,973 men (11,360 killed and 32,613 wounded). The report further shows that the infantry lost more men than all other arms combined; its losses were ten times greater than those of the cavalry or foot artillery, and its dead about ten times that of the field artillery. The losses of engineers also were large, both in dead and wounded, because of the extraordinary persistency with which the Japanese returned continually to the assaults on Port Arthur. The high figures of losses in the medical corps (18 per cent) nearly equal to those in the cavalry is a proof of more of the courage with which they were led, even into disaster. The officers show a greater loss than the privates in the list of those fallen in battle; there are 120 per cent of officers to 90 per cent of privates.

That is a significant and typical fact for all modern war.—*Ueber die Gesamten Armeen und Flotten.*

The *Kangaroo,* the submersible or submarine boat carrier, described on page 807 of the PROCEEDINGS is now on her way from Toulon to Callao carrying the submersible *Ferre* of the *Laubeuf* type built by the Schneiders for the Peruvian Government. This boat was successfully taken on board and stored for transport on June 28. A complete description, with plans, is to be found in *Engineering* of July 19, 1912.

THE FIFTH OLYMPIC TRIUMPH.—At Stockholm, for the fifth time since the revival of the Olympic games, the United States has finished first in the international competition, on this occasion leading in points in all events and making a "clean sweep" of the track meet. In the opening games, held at Athens in 1896, Americans scored eight "firsts" against five for Great Britain, one for Greece and one for Denmark. At Paris, in 1900, we won seventeen of the twenty-three athletic events, and at St. Louis, in 1908, twenty-four out of twenty-six. Deplorable circumstances that did not tend to exalt the British ideal of sportsmanship attended the London games of 1908. Great Britain claimed the victory, partly because of her supremacy in pastimes like "miniature rifle shooting," whatever that may mean, yet in the track and field events, the contests in which the American team actually appeared, we won almost twice as many points as our English rivals. It would be quite fair to say that in all the sports that properly form a part of such a meet and by any fair interpretation of the laws of sport, we have carried off the honors from the beginning; and though at the Pan-Hellenic games, another international competition held at Athens in 1906, the American team was crippled by internal dissensions, we maintained the record of supremacy by winning eleven "firsts" against four for Great Britain, three for Greece and two for Sweden.

FINAL STANDING IN OLYMPIC MEET.—United States, 128; Sweden, 104; Great Britain, 66; Finland, 46; Germany, 34; France, 23; South Africa, 10; Denmark, 14; Italy, 13; Canada, 13; Australia, 13; Belgium, 11; Norway, 10; Hungary, 8; Russia, 5; Greece, 4; Austria, 4, Holland, 2.

In the track and field events the final standing is as follows:

United States, 85; Finland, 27; Sweden, 24; Great Britain, 14; Canada, 7; South Africa, 5; France, 4; Germany, 4; Greece, 4; Norway, 2; Hungary, 1; Italy, 1.

BOOK NOTICES.

"The Electric Propulsion of Ships." By H. M. Hobart, M. Inst. C. E. Published by Harper Bros. Price $2.00 net.

It has not been until quite recently that electrical engineers have recognized the fact that there may be a fairly wide field for the use of electrical machinery as a means of propelling ships.

The author says: "I have made serious efforts to acquire a reasonable knowledge of the broad aspects of the subject from the marine engineer's point of view. As an electrical engineer, it would be futile for me to attempt to assimilate the marine engineer's data in more than a very rough way, but I have sought to do this and to place my results before electrical engineers in ways which, I trust, may be useful to them. I believe I shall fairly conclusively show that the incorporation of suitable electrical methods in ship propulsion is commercially advantageous in many cases, and I shall try to roughly outline the limitations; that is to say, I shall try to indicate the boundary line between the appropriate and the inappropriate cases. With the wealth of data at the disposal of the marine engineers and with their close knowledge of many detail considerations, I am in hopes they, with the further aid of the data which I contribute in this treatise, will be able to still more clearly define these boundaries."

The following list gives the chapter headings:

I. Introductory.
II. The Size and Power of Ships.
III. The Energy Required per Ton Mile in Propelling Ships at Constant Speed.
IV. The Frictional Resistance of Ships.
V. The Momentum of Ships.
VI. The Speed and Efficiency of Propellors.
VII. Mechanical Speed Reduction for Steam Turbines.
VIII. Electrical Speed Reduction Gearing for Steam Turbines.
IX. The Use of Super Heated Steam in Marine Engines.
X. Electrical Gear as a Means of Improving the Load Factor.
XI. Internal Combustion Engines for Ship Propulsion.
XII. Alternating and Continuous Current Electricity for Ship Propulsion.
XIII. Some Systems of Propelling Ships Electrically.
XIV. The Alter Phase System for Ship Propulsion.
XV. The Durtnall System of Propelling Ships.
XVI. The Emmet System of Ship Propulsion.

The above quotations and list of chapter headings give a good idea of the scope of this book and of the problems attacked, although the author

might have rightfully added that he would set forth the results of his efforts in such a manner that it could be calculated to be of interest not only to electrical and mechanical engineers and naval architects but also to everyone who has anything to do with ships, commercially or otherwise.

The author quotes freely the opinions of acknowledged authorities on many of the points connected with the various elements entering into the subject under discussion, and the reader cannot fail to be impressed with the effort of the author to set forth the results of his investigations in a remarkably disinterested and unbiased manner.

Naturally no attempt can be made to cover every consideration that enters into the relative advantages and disadvantages of each proposed kind of ship propulsion that is discussed in this book of 162 pages but many of the salient points are touched on, so that even a lay reader may understand how much effort naval architects and engineers are now making to bring about changes that ought to increase the efficiency in propulsion of ships of the navy and merchant marine, and, on the whole, a perusal of this treatise leaves one with an increased appreciation of the wide range and complexity of conditions that confront those who are working in this field of invention and with an eagerness to learn the results of practical tests and applications of the various systems under development.

It is expected that important data will be obtained from the comparative performances of the three U. S. Navy colliers *Cyclops, Neptune,* and *Jupiter,* each of about 19,000 tons displacement and of 14 knots speed, similar except as to type of propelling machinery, the *Cyclops* having excellent reciprocating engines, the *Neptune* having Parsons' turbines and Westinghouse reduction gear and the *Jupiter* is to have turbo generators and induction motors built by the General Electric Company.

The Diesel engine, as a type of ship propulsion machinery, is now holding the attention of marine engineers to a marked degree and it now seems probable that the use of electricity for ship propulsion is going to depend, to a great extent, upon the success of the Diesel engine in fulfilling the requirements of reliability, reversibility, etc., demanded by large ships of high speed.

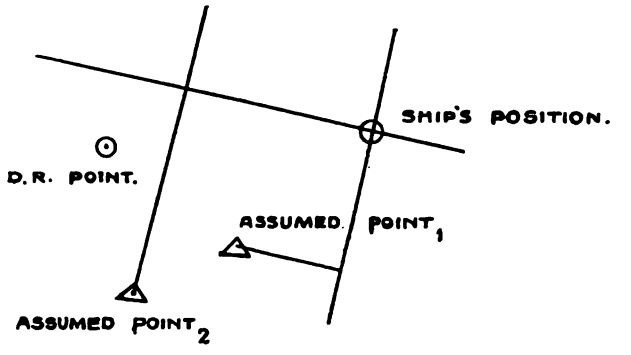
C. M. TOZER,
Lieut.-Commander, U. S. Navy.

"Altitude and Azimuth Tables."* Second Edition. By Lieut.-Commander Radler de Aquino, Brazilian Navy. Published by J. D. Potter, 145 The Minories, London, E. C., price $2.50 net.

This edition has some new tables added which comprise about 35 pages.

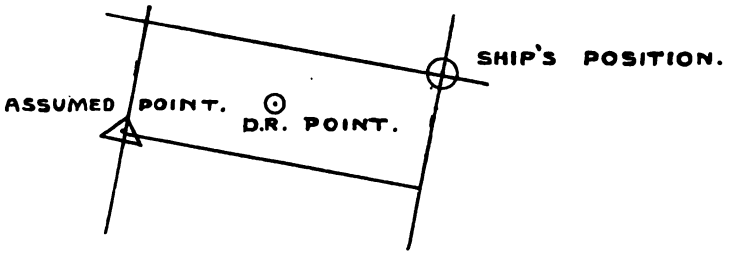
In explaining the use of these tables the author states that he, after mature consideration, prefers to use in solving, by means of tables, the specific problems of astronomical navigation an *estimated* point in place of an *auxiliary* point as a basis for calculating the determinative elements of lines of position (especially when 2, 3, or 4 stars are observed). In his book he names the points as follows:

* For an explanation of the use of these tables consult NAVAL INSTITUTE PROCEEDINGS, No. 128, December, 1908, Vol. 34, No. 4.



The assumed point is one found during the solution of the problem.

In the use of this second edition of tables he intends that *one* point shall be taken and the calculations made from that instead of having two assumed points.



The following matter is quoted from his descriptive pamphlet on the subject:

The simplification now introduced in the regular formula (actually used officially in the English Navy and already adopted by us in 1899 in our "The Method of Marcq Saint Hilaire"), permits the reduction of tables necessary to solve to *two* only and *avoids* the necessity of knowing the *auxiliary arco,* as happens in the tables of Martelli, Pouvreau, Bankos, etc., whose approximation is in many cases insufficient.

The determination of the altitude of a star with our tables is direct, which is not the case in those tables made especially for the calculation of the *hour angle.*

FORMULA V AND TYPICAL EXAMPLE.

When the hour angle of a star (t), its declination (d), and the lat. of the observers (L) are given, we will be able to find very rapidly and with great accuracy the altitude (h) of a star, as follows:

If, in the fundamental equation

$$\cos (90-h) \text{ or } \sin h = \sin L \sin d + \cos L \cos d \cos t, \qquad (1)$$

we should make

$$\cos t = 1 - 2 \sin^2 \tfrac{1}{2} t,$$

we will have

$$\cos (90-h) = \cos (L-d) - 2 \cos L \cos d \sin^2 \frac{t}{2}, \qquad (2)$$

or

$$1 - \cos (90-h) = \cos (L-d) - 2 \cos L \cos d \sin^2 \frac{t}{2}.$$

If we make

$$2 \cos L \cos d \sin^2 \frac{t}{2} = \text{versin } \theta = 2 \sin^2 \frac{\theta}{2}, \qquad (3)$$

we will have

$$\text{versin } (90 - h) = \text{versin } (L - d) + \text{versin } \theta. \qquad (4)$$

Inverting equation (3),

$$2 \cos L \cos d \sin^2 \frac{t}{2} = 2 \sin^2 \frac{\theta}{2},$$

and multiplying both members by 2, we will have

$$\sec L \sec d \operatorname{cosec}^2 \frac{t}{2} = \operatorname{cosec}^2 \frac{\theta}{2}.$$

Applying the logarithms to both members and dividing by 2, we will have

$$\tfrac{1}{2} \log \sec L + \tfrac{1}{2} \log \sec d + \log \operatorname{cosec} \frac{t}{2} = \log \operatorname{cosec} \frac{\theta}{2}. \qquad (5)$$

Then in accord with formulas (4) and (5) we are able to determine the altitude by means of our *New Tables.*

The first eight pages give us $\frac{1}{2} \log \sec L + \frac{1}{2} \log \sec d$. The 18 pages following give us in the columns marked "Hour Angle" the log cosec $\frac{t}{2}$ or log cosec $\frac{\theta}{2}$, when we enter with t or θ as arguments. The last nine pages give log cosec $\frac{t}{2}$ when t is greater than 90° and less than 270°.

In the columns marked "Sum and Diff." we obtain the versin $(L + d)$ or the versin $(L - d)$, and also in the same columns the versin θ corresponding to log cosec $\frac{\theta}{2}$ given in the columns marked "Hour Angle."

The corresponding altitude to vers $(90 - h)$ will be found below in the columns marked "Alt."

Each one of the versines and logarithms is multiplied by 10^6 to turn them into whole numbers. In this form characteristics do not appear.

TYPICAL EXAMPLE.

Feb. 21, 1910. 8h a.m. Lat. est.= 36° 52′ N.; Long. est.= 8° 06′ W. True alt. ☉ was 21° 07′ at 21h 06m 11s by chro. slow 6m 59s on G. M. T. Required the est. alt.

C.=	21h	6m	11s		
CC.=	+	6	59		
G. M. T.=	21h	13m	10s		
Eq. T.=	−	13	46		
G. A. T.=	20h	59m	24s	or t_G =	314° 51′
				G =	8 6
				t =	306° 45′

t =	306° 45′	[log cosec $\frac{t}{2}$]	34858		
L =	36 52 N	[½ log sec L]	4845		
d =	10 27 S	[½ log sec d]	363		
		[log cosec $\frac{\theta}{2}$]	40066	31709	(vers θ)
$L + d$ =	47° 19′		32205		(vers. $(L + d)$)
			63814		(vers $(90 - h)$)
		h =	21° 13′		

EXPLANATION.

After applying the chro. correction to the chro. time, and the equation of time to the G. M. T., we will have the G. A. T. or T_G — the H. A. of the sun in relation to Greenwich, counted to the East, t_G being the G. A. T. *converted into degrees.**

The combination of this t_G with the estimated longitude gives us the L. A. T. reckoned to the East.

Thus we will have $t = 306° 45'$.

The sun's declination found from the Nautical Almanac, at the same time as the equation of time, is taken with approximation to minutes.

When L and d are of the same name both N or both S, subtract the less from the greater.

If they are of opposite names, as in our example, one N and the other S, add the two.

Thus we will have $L + d = 47° 19'$.

Entering the first tables with $L = 36° 52'$ and with $d = 10° 27'$, we will find respectively 4845 and 363.

Entering the succeeding tables with $t = 306° 45'$ in the column headed "Hour Angle," we will find 34858, which, added to the corresponding numbers $L + d$, will give 40066.

When t is less than 180°, we enter the tables from the top, and the star is to the westward of the meridian. When t is greater than 180°, we enter the tables from the bottom and the star is to the eastward of the meridian.

We now pick out the number 40066 in the same column ("Hour Angle") and opposite to that, in the column "Sum or Diff." we will find 31609. Adding this number 31609 to the number 3205 corresponding to 47° 19' in the column "Sum or Diff." we will find 63814. This number corresponds to 21° 13' in the column "Alt." (reading from the bottom).

The estimated altitude is, therefore 21° 13'.

TABLES OF AZIMUTH.

The azimuth can be rapidly and easily found by the following methods, already explained in our "Altitude and Azimuth Tables."

EXAMPLE: Given $t = 53° 15'$ E; $d = 10° 27'$ S and $L = 36° 52$ N. To find the azimuth (Z).

Entering the tables with $d = 10° 30'$ and with $t = 53°$, we will find approximately, $a = 52°$ and $b = 17°$. Combining b with L, we will have $C = 54°$ and entering again the tables with $a = 52°$ and $C = 54°$, we will find $Z = 57° 42'$.

Generally (when $Z < 70°$) it will not be necessary to combine b with L. It will suffice to go down the column h/d corresponding to $a = 52°$ until we find the value of $h = 21° 13'$ and to one side we will find $Z = 57° 42'$.

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* It is not necessary to repeat here but once that, by the immediate conversion of G. A. T. from "time" into "arc," you have the triple advantage of simplifying the finding of t, of abolishing the argument of time in the tables and the necessity of working with quantities expressed in time and in arc after this conversion.

b / B	a=10° 30′						a=11° 0′						a=11° 30′						c / C
	d / h		60′/Δ	t / Z		Δ/60′	d / h		60′/Δ	t / Z		Δ/60′	d / h		60′/Δ	t / Z		Δ/60′	
°	°	′		°	′		°	′		°	′		°	′		°	′		°
45	44	3	1.03	14	41	0.25	43	57	1.03	15	22	0.27	43	52	1.05	16	3	0.28	**45**
46	45	1	1.03		56	.27	44	55	1.03		38	.28	44	49	1.03		20	.28	44
47		59	1.03	15	12	.28	45	53	1.03		55	.28	45	47	1.05		37	.30	43
48	46	57	1.05		29	.30	46	51	1.05	16	12	.30	46	44	1.03		55	.32	42
49	47	54	1.03		47	.30	47	48	1.03		30	.33	47	42	1.05	17	14	.33	41
50	48	52	1.03	16	5	0.33	48	46	1.05		50	0.33	48	39	1.05		34	0.35	**40**
51	49	50	1.05		25	.33	49	43	1.05	17	10	.35	49	36	1.05		55	.37	39
52	50	47	1.03		45	.37	50	40	1.05		31	.38	50	33	1.05	18	17	.40	38
53	51	45	1.05	17	7	.38	51	37	1.05		54	.40	51	30	1.05		41	.42	37
54	52	42	1.05		30	.40	52	34	1.05	18	18	.42	52	27	1.07	19	6	.43	36
55	53	39	1.05		54	0.43	53	31	1.05		43	0.45	53	23	1.05		32	0.47	**35**
56	54	36	1.05	18	20	.47	54	28	1.05	19	10	.48	54	20	1.07	20	0	.48	34
57	55	33	1.05		48	.48	55	25	1.07		39	.50	55	16	1.07		29	.52	33
58	56	30	1.07	19	17	.50	56	21	1.07	20	9	.53	56	12	1.07	21	0	.55	32
59	57	26	1.05		47	.55	57	17	1.07		41	.57	57	8	1.07		33	.58	31
60	58	23	1.07	20	20	0.58	58	13	1.07	21	15	0.60	58	4	1.09	22	8	0.63	**30**
61	59	19	1.07		55	.63	59	9	1.07		51	.65		59	1.09		46	.67	29
62	60	15	1.09	21	33	.65	60	5	1.09	22	30	.68	59	54	1.09	23	26	.70	28
63	61	10	1.07	22	12	.72	61	0	1.09	23	11	.73	60	49	1.09	24	8	.77	27
64	62	6	1.09		55	.77		55	1.09		55	.78	61	44	1.11		54	.80	26
65	63	1	1.09	23	41	0.82	62	50	1.11	24	42	0.85	62	38	1.11	25	42	0.87	**25**
66		66	1.11	24	30	.88	63	44	1.11	25	33	.90	63	32	1.11	26	34	.93	24
67	64	50	1.11	25	23	.95	64	38	1.11	26	27	.98	64	26	1.13	27	30	1.00	23
78	65	44	1.11	26	20	1.02	65	32	1.13	27	26	1.05	65	19	1.15	28	30	1.08	22
69	66	38	1.13	27	21	1.10	66	25	1.15	28	29	1.13	66	11	1.15	29	35	1.17	21
70	67	31	1.15	28	27	1.20	67	17	1.15	29	37	1.22	67	3	1.18	30	45	1.25	**20**
71	68	23	1.15	29	39	1.30	68	9	1.18	30	50	1.33		54	1.18	32	0	1.37	19
72	69	15	1.18	30	57	1.42	69	0	1.20	32	10	1.45	68	45	1.22	33	22	1.47	18
73	70	6	1.20	32	22	1.55		50	1.20	33	37	1.58	69	34	1.22	34	50	1.60	17
74		56	1.20	33	55	1.68	70	40	1.25	35	12	1.72	70	23	1.25	36	26	1.73	16
75	71	46	1.25	35	36	1.85	71	28	1.25	36	55	1.87	71	11	1.30	38	10	1.90	**15**
76	72	34	1.28	37	27	2.03	72	16	1.30	38	47	2.05		57	1.30	40	4	2.07	14
77	73	21	1.33	39	29	2.23	73	2	1.33	40	50	2.23	72	43	1.40	42	8	2.25	13
78	74	6	1.36	41	43	2.45		47	1.40	43	4	2.47	73	26	1.43	44	23	2.45	12
79		50	1.43	44	10	2.70	74	30	1.46	45	32	2.68	74	8	1.50	46	50	2.68	11
80	75	32	1.50	46	52	2.97	75	11	1.58	48	13	2.95		48	1.58	49	31	2.93	**10**
81	76	12	1.58	49	50	3.27		49	1.62	51	10	3.23	75	26	1.71	52	27	3.18	9
82		50	1.76	53	6	3.57	76	26	1.82	54	24	3.52	76	1	1.82	55	38	3.45	8
83	77	24	1.94	56	40	3.92		59	2.00	57	55	3.82		34	2.07	59	5	3.73	7
84		55	2.14	60	35	4.23	77	29	2.22	61	44	4.32	77	3	2.40	62	49	4.00	6
85	78	23	2.61	64	49			56	2.73	65	51	4.42		28	2.73	66	40	4.27	**5**
86		46	3.16	69	23		78	18	3.33	70	16			50	3.53	71	5	4.48	4
87	79	5	3.75	74	14			36	4.62	74	56		78	7	4.62	75	34		3
88		19	7.50	79	20			49	7.50	79	49			20	8.57	80	16		2
89		27	20.0	84	37			57	20.00	84	52			27	20.00	85	6		1
90		30		90	0		79	0		90	0			30		90	0		**0**
t	a		60′/Δ	b		Δ/60′	a		60′/Δ	b		Δ/60′	a		60′/Δ	b		Δ/60′	
	d=10° 30′						d=11° 0′						d=11° 30′						

b / B	a=51° 0′					a=51° 30′					a=52° 0′					c / C
	d / h	60′/Δ		t / Z	Δ/60′	d / h	60′/Δ		t / Z	Δ/60′	d / h	60′/Δ		t / Z	Δ/60′	
°	° ′			° ′		° ′			° ′		° ′			° ′		°
0	0 0	1.58		51 0	0.00	0 0	1.62		51 30	0.00	0 0	1.62		52 0	0.00	**90**
1	38	1.58		0	.02	37	1.58		30	.02	37	1.62		0	.02	89
2	1 16	1.62		1	.02	1 15	1.62		31	.02	1 14	1.62		1	.02	88
3	53	1.58		2	.03	52	1.62		32	.03	51	1.62		2	.03	87
4	2 31	1.58		4	.03	2 29	1.58		34	.03	2 28	1.62		4	.03	86
5	3 9	1.58		6	0.05	3 7	1.62		36	0.05	3 5	1.67		6	0.05	**85**
6	47	1.62		9	.07	44	1.62		39	.05	41	1.62		9	.05	84
7	4 24	1.58		13	.07	4 21	1.62		42	.07	4 18	1.62		12	.07	83
8	5 2	1.62		17	.07	58	1.62		46	.08	55	1.62		16	.08	82
9	39	1.62		21	.08	5 35	1.62		51	.08	5 32	1.67		21	.08	81
10	6 16	1.58		26	0.08	6 12	1.62		56	0.08	6 8	1.62		26	0.08	**80**
11	54	1.62		31	.10	49	1.62		52 1	.10	45	1.67		31	.10	79
12	7 31	1.62		37	.12	7 26	1.62		7	.10	7 21	1.62		37	.10	78
13	8 8	1.62		44	.12	8 3	1.62		13	.12	58	1.67		43	.12	77
14	45	1.62		51	.12	40	1.67		20	.13	8 34	1.67		50	.13	76
15	9 22	1.62		58	0.13	9 16	1.62		28	0.13	9 10	1.67		58	0.13	**75**
16	59	1.62		52 6	.15	53	1.67		36	.15	46	1.67		53 6	.13	74
17	10 36	1.62		15	.15	10 29	1.67		45	.15	10 22	1.67		14	.15	73
18	11 13	1.67		24	.17	11 5	1.67		54	.15	58	1.67		23	.17	72
19	49	1.62		34	.17	41	1.67		53 3	.17	11 34	1.71		33	.17	71
20	12 26	1.67		44	0.18	12 17	1.67		13	0.18	12 9	1.67		43	0.18	**70**
21	13 2	1.67		55	.18	53	1.67		24	.18	45	1.71		54	.18	69
22	38	1.67		53 6	.20	13 29	1.67		35	.20	13 20	1.71		54 5	.20	68
23	14 14	1.67		18	.20	14 5	1.71		47	.22	55	1.71		17	.20	67
24	50	1.67		30	.22	40	1.71		54 0	.22	14 30	1.71		29	.22	66
25	15 26	1.71		43	0.23	15 15	1.71		13	0.22	15 5	1.71		42	0.22	**65**
26	16 1	1.71		57	.23	50	1.71		26	.23	40	1.76		55	.23	64
27	36	1.71		54 11	.25	16 25	1.71		40	.25	16 14	1.76		55 9	.25	63
28	17 11	1.71		26	.27	17 0	1.76		55	.25	48	1.76		24	.25	62
29	46	1.76		42	.27	34	1.76		55 10	.27	17 22	1.76		39	.27	61
30	18 20	1.71		58	0.27	18 8	1.76		26	0.28	56	1.82		55	0.27	**60**
31	55	1.76		55 14	.28	42	1.76		43	.28	18 29	1.82		56 11	.28	59
32	19 29	1.76		31	.30	19 16	1.82		56 0	.30	19 2	1.82		28	.30	58
33	20 3	1.76		49	.30	49	1.82		18	.30	35	1.82		46	.30	57
34	37	1.82		56 7	.32	20 22	1.82		36	.32	20 8	1.82		57 4	.32	56
35	21 10	1.82		26	0.33	55	1.82		55	0.32	41	1.88		23	0.32	**55**
36	43	1.88		46	.35	21 28	1.88		57 14	.33	21 13	1.88		42	.33	54
37	22 15	1.82		57 7	.35	22 0	1.88		34	.35	45	1.88		58 2	.35	53
38	48	1.88		28	.35	32	1.88		55	.37	22 17	1.94		23	.35	52
39	23 20	1.88		49	.37	23 4	1.94		58 17	.37	48	1.94		44	.37	51
40	52	1.94		58 11	0.38	35	1.94		39	0.38	23 19	1.94		59 6	0.38	**50**
41	24 23	1.94		34	.40	24 6	1.94		59 2	.38	50	2.00		29	.38	49
42	54	1.94		58	.40	37	2.00		25	.40	24 20	2.00		52	.38	48
43	25 25	2.00		59 22	.42	25 7	2.00		49	.40	50	2.07		60 15	.42	47
44	55	2.00		47	.42	37	2.00		60 13	.43	25 19	2.07		40	.42	46
45	26 25			60 12		26 7			39		48			61 5		**45**
t	a	60′/Δ	b		Δ/60′	a	60′/Δ	b		Δ/60′	a	60′/Δ	b		Δ/60′	
	d=51° 0′					d=51° 30′					d=52° 0′					

As we see, the first process is more simple than that of the A, B and C Tables, so much in vogue at present, for the combination of b and L is less complicated than the juggling with signs, and still more we have at our disposition a great abundance of arguments that give Z to half degrees without being necessary to interpolate.

The second method (that can *almost always* be employed) offers the same advantages as tables with three arguments (Davis, Labrosse, etc.), with the evident advantage of less bulk in our tables, that correspond to all declinations, all latitudes, all altitudes, and all hour angles, which is not the case with other tables.

A. B. HOFF,
Commander, U. S. Navy.

"Tin Soldiers." The Organized Militia and What It Really Is. By Walter Merriam Pratt, a first lieutenant in the 8th Massachusetts Infantry, with a foreword by Captain George E. Thorne, 24th Infantry, U. S. A. Published by Richard G. Badger, The Gorham Press, Boston. 182 pages and sixteen full page illustrations, price $1.62, postpaid.

This book is short, easy reading, the information it contains is intensely interesting, valuable and new to most people, and deserves to be read carefully by all doubters of as well as believers in the efficiency of the militia. The doubt is always due to ignorance and this book removes that. As the foreword explains, the militia has often been heavily and thoughtlessly maligned, but their importance is steadily increasing, and with this increase a better recognition of their work and usefulness is coming about.

The change in the militia from (1) merely citizens, then (2) trained bands, to (3) volunteers organized, but for state uses only, and finally (4) to the organized militia of to-day, armed, equipped, and uniformed as the regular army and subject to the call of the general government for service anywhere is sketched by the author.

The Dick Bill created an organized force of over 110,500 trained men, available in any locality, for national defense. To be more exact, there are at present 121,580 men and officers in the organized militia of the United States, and 15,493,125 in the reserve or unorganized militia.

The militia is being systematically and logically subdivided so as to make a completely balanced force when it is called upon to take the field, thus the proportions of infantry, cavalry, field artillery, engineers, signal troop, ambulance parties, and field hospitals to each other are rapidly becoming correct, this to the great advancement of general efficiency.

One who reads this book will leave it with a high idea of the earnestness and capability of its officers and men. The movement on foot in what is known as the Federal Pay Bill to compensate for their services seems to be very necessary and wise. The expenses of the annual encampments have sometimes had to be met by the assessment of individual dues.

The author describes the busy life of the officers with his studies and the many duties entailing upon him during drills, recruiting, instructions, etc., over and above that of the ordinary business man. The enlisted

man's outfit, as described, is complete and conforms absolutely to that of the regular army.

The organized militia is thoroughly discussed in its every phase, as are also its various duties.

Strike duty, in particular, is dealt with in detail. The experiences in the strike at Lawrence, Mass., January and February, 1912, are quoted. They show a capable organization, and that before the strike ended the militia had earned the respect of all, save professional agitators.

Their work at the various yearly maneuvers is written up in detail. Of especial interest are the pages dealing with the regular army encampment at San Antonio, in the summer of 1911, which was attended by many officers of the militia. The notes made by them show that their time was well spent and of much benefit to the militia. Their account is graphic of the discipline and drills, showing the efficiency of our regulars there under the command of General Carter.

Every young man is urged by the author to serve at least one enlistment in the regular army or the national guard, such service to be considered by him as a debt he owes to his country and flag. Such advice is too good, too good and valuable it is feared to ever be extensively followed.

The organized militia is no longer considered by the government as a kind of state police force. It is the secondary force of the United States Army for the National defence.

The tabulation of strength of our force with that of other countries in proportion to area and population to be protected is instructive.

RALPH EARLE.

La Marine Francaise en 1912. Le Programme Naval, by Captain A. Poidlouë, of the French Navy, formerly in command of the *Democratie*, *Montcalm* and *Chauteau-Renault*. Published by A. Challamee, 17 Rue Jacob, Paris, one volume, 122 pages. Price $ .50.

The discussion of the naval needs of France points out that she should command the Mediterranean, and her fleet should therefore be greater than that of Italy and Austro-Hungary combined.

The question of the command of the fleet in France is unfavorably compared with that of Germany and Great Britain, in that the command of the fleet in the former is assigned for short terms and to officers with no particular fitting or training for the same, and without high rank, while the two latter nations have an admiral, with a specially high rank, placed in supreme command for many years, and he is always one peculiarly fitted for this position both by training and personality.

Ships, dry docks, ports, powders and guns are compared with those of Germany and Great Britain.

The necessity of maneuvers on a large scale and of retaining units always in the fleet, using cruisers for the duties of peace in foreign lands is brought out forcibly.

The work is interesting to all students of naval progress.

RALPH EARLE.

"The Life of Lord Nelson." By Geoffrey Callender, B. A., of the Royal Naval College, Osborne, published by Longmans, Green & Co., 39 Paternoster Row, London. 148 pages with a naval glossary and many interesting and valuable illustrations.

The text of this book has been thoroughly enjoyed by those who have been fortunate enough to have read "Sea Kings of Britain," by the same author. It is history written instructively and entertainingly, and is thus peculiarly adapted for use in schools in the historical courses. In addition there is an introduction of 38 pages containing a plate of and complete description of vessels of that date, together with some excellent tactical notations. The illustrations are all new, interesting and valuable; that showing Nelson leading a boarding party to the *San Nicolas* at the battle of St. Vincent, and that showing a longitudinal section of the *Victory* are especially worthy of mention.

RALPH EARLE

LIST OF PRIZE ESSAYS.

1879.

Naval Education. Prize Essay, 1879. By Lieut.-Com. A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880.

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881.

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882.

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut.-Com. F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883.

How may the Sphere of Usefulness of Naval Officers be extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884.

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885.

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886.

What Changes in Organization and Drill are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887.

The Naval Brigade: its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888.

Torpedoes. Prize Essay, 1888. By Lieut.-Com. W. W. Reisinger, U. S. N.

1891.

The Enlistment, Training and Organization of Crews for our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892.

Torpedo-boats: their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894.

The U.S.S. Vesuvius, with Special Reference to her Pneumatic Battery. Prize Essay, 1894. By Lieut.-Com. Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895.

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut.-Com. Richard Wainwright, U. S. N.

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1896.

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THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

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1897.

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TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

1898.

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut.-Com. Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900.

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1903.

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SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904.

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A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905.

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THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear-Admiral Stephen B. Luce, U. S. N.

1906.

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1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1913. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. If, in the opinion of the Board of Control, the best essay presented is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention" or such other distinction as the Board may decide.

5. In case one or more essays receive "Honorable Mention," the writer of the first of them in order of merit will receive seventy-five dollars and a life-membership in the Institute.

6. Any essay not having received honorable mention may be published also, at the discretion of the Board of Control, but only with the consent of the author.

7. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

8. All essays submitted must be either typewritten or copied in a clear and legible hand.

9. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

RALPH EARLE,
Lieut.-Commander, U. S. N., Secretary and Treasurer.

MEDAL PRESENTED TO WINNER
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The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now enters upon its thirty-ninth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute. by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII.

Sec. 1. The Institute shall consist of regular, life, honorary, and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control, and a vote equal to one-half the number of regular and life members, given by proxy or presence, shall be cast, a majority electing.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

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The Proceedings are published quarterly and anyone may subscribe for them. The annual subscription is $3.00; single copies, 75 cents. Annual dues for members and associate members, $2.00. Fee for life membership, $30.00.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

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The writers only are responsible for the contents of their respective articles.

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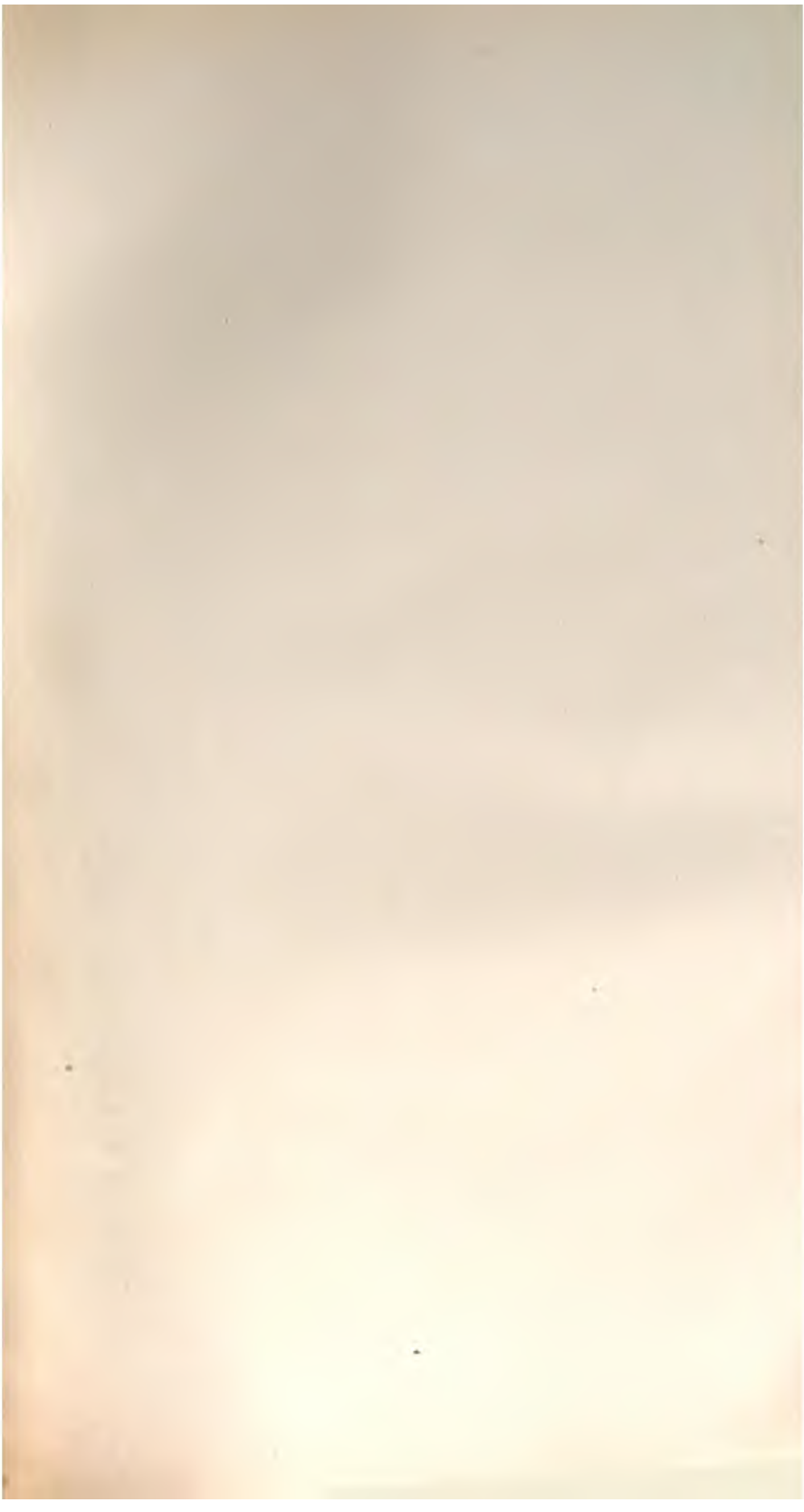

G. R. Simonds

U. S. S. D-2, MAKING A SURFACE RUN

UNITED STATES NAVAL INSTITUTE
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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MILITARY VALUE AND TACTICS OF MODERN SUBMARINES.

By LIEUTENANT C. W. NIMITZ, U. S. Navy.

VALUE AND TACTICS OF THE MODERN SUBMARINE.

The military value of any vessel designed for war purposes depends largely on the following factors:

A. *Communication,* or the ability to transmit and receive information or battle orders either before or during contact with an enemy.

B. *Mobility,* or the ability to move quickly from place to place in all conditions of weather. Under this factor may be included the habitability of the vessel, or its ability to maintain a crew in normal health and fighting power.

C. *Invulnerability,* or the ability to resist attack.

D. *Offensive strength,* or the ability to deal a telling blow when in contact with the enemy.

In estimating the military value of the submarine or submersible, as compared with the modern battleship, we find that each has a distinct and separate value. The battleship on account of its mobility as defined above can operate where submarines or submersibles of the present day cannot go, due to their lack of mobility. On the other hand, leaving out the factor of mobility, which for submarine craft of the future will advance more rapidly than for surface craft, we find that submarine craft rank equally well, if not better than surface craft.

COMMUNICATION.

Submarine craft on the surface within sight of each other have the same ability as other surface craft to communicate freely, using for this purpose the various systems of day and night signalling used in surface craft. For long distance signalling the submarine or submersible has a radio outfit capable of operating at distances up to fifty (50) miles. As the range of the radio outfit depends on the height of the aerial, the larger submarine boats can easily obtain a greater range by using higher masts. The present practice consists in carrying the portable aerial on two masts which fold down on the deck just before submerging. The sending and receiving apparatus is permanently installed in

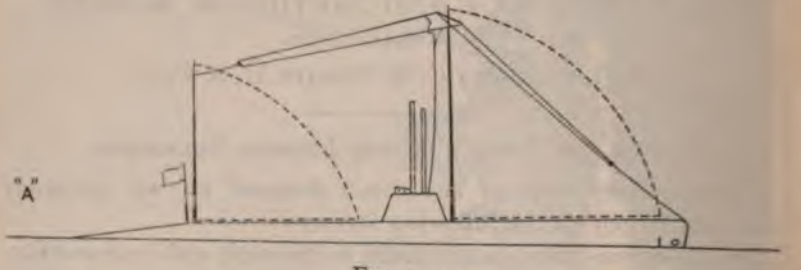


FIG. 1.

the forward end of the submarine, as far as possible from the noise and vibration of the propelling machinery. Sketch "A."

The sketch shows the arrangement of the masts and aerial as rigged on submarines in our service. In this rig the aerial is about thirty (30) feet above the deck, and can be taken down ready for submergence in five (5) minutes. The value of the radio outfit in time of war is greatly increased by the proper use of fast scouting vessels also equipped with radio.

For communicating below the surface, submarine craft use bell signals, the bell being sounded by a pneumatically operated striker from inside the boat. Under the most favorable circumstances, with all machinery stopped, boats have exchanged signals at distances up to eight (8) miles. Under the most unfavorable conditions, with boats running away from each other on opposite courses, signals have been exchanged at distances up to one-half of one mile. Numerous experiments have been made to establish

reliable radio communication below the surface, but, up to the present, without success.

As submarine craft on " station " or prior to sighting an enemy's smoke will habitually remain on the surface, and as submerged communication by means of a bell or sounding apparatus can be intercepted by friend or foe alike, there is no practical value to this method of communication, except to avoid collision in training exercises in time of peace. A group of submarines operating submerged and using bell signals in the presence of an enemy can easily be located along certain lines of bearing. If then, the enemy is equipped with receiving apparatus as most modern ships are, he has only to run away to avoid torpedo attack. The submerged speed of a submarine or submersible will never equal or exceed the surface speed of a battleship unless that battleship is disabled, therefore a submarine commanding officer should be very loath to sound his bell for safety's sake, and thus lose the chance of coming within torpedo range.

MOBILITY.

The development of the Diesel internal combustion engine has added greatly to the mobility and safety of the submarine. Among the many advantages of the Diesel engine over the gasoline engine are the following:

(a) Economy in cost and consumption of fuel.
(b) Increased cruising radius for a given tank capacity.
(c) Increased reliability of performance.
(d) Greater safety in handling of fuel.
(e) Absence in engine room of noxious fumes and gases.

The fuel consumption per horse-power hour varies slightly with the size and speed of the engine, being lowest for large and slow speed engines, and a little higher for small and high speed engines. A fair average fuel consumption is .5 lbs. per brake horse-power per hour. The average specific gravity of ordinary fuel oil is .89, equivalent to 7.4 lbs. per gallon. The fuel consumption therefore amounts to .54 of a pint per horse-power hour. The average price of such oil is 3 cents per gallon, making an average fuel cost of .2 cents per brake horse-power. In a gasoline engine of about the same power, the average consumption is one pint per horse-power hour. With gasoline at an average cost of

12 cents per gallon, the cost of the gasoline engine is 1.5 cents per brake horse-power hour, or about 7½ times the cost of the fuel oil engine.

The use of the internal combustion fuel oil engine has practically doubled the cruising radius of submarines and has made it possible for these craft to have about the same cruising radius as a modern battleship. The surface speed of the submarine is naturally not as high as that of a battleship, due to the spindle form of hull of the former, that being a poor form for surface speed, but an excellent form for submerged speed and strength. In order then to attain the surface speed necessary to permit a group of submarines to cruise with a battle fleet, it will be necessary to adopt a "ship shape" form of hull, and thus sacrifice a small amount of submerged speed and strength. Whereas contractors guarantee a strength capable of withstanding a pressure at 200 feet in a submarine of the spindle form, they will only guarantee 150 feet submergence, with safety, with the "ship-shape" form of hull.

The total absence of an ignition system and all of its attendant troubles tends to greater reliability of motive power. With the two-cycle reversible type of heavy oil engine, the number of moving parts is reduced to a minimum, and the engine is very compact and easily accessible for overhauling.

The use of heavy oil instead of gasoline in submarine craft has removed the greatest source of danger. The only accidents worthy of mention in our service have been due to gasoline fires in the torpedo compartment, or in the engine room. The moral effect on the crew caused by the removal of the gasoline danger cannot be overestimated.

In the use of gasoline engines, there is always an odor of raw gasoline or of burned gasoline in the engine room. In fine smooth weather, it has been possible to keep the engine room fairly well ventilated, but in rough weather the hatches must be battened down, thus making it very difficult to rid the boat of fumes. Numerous cases of "gasoline jags" have occurred both at sea and in port. The victim on watch in the engine room inhales the raw gasoline fumes which come from the engines or from the fuel pumps, which are very difficult to keep tightly packed. He gradually loses his senses, and just before lapsing into total unconsciousness, becomes very violent. If he is not

immediately removed from the engine room he may fall into the moving machinery. The aid of several men is sometimes necessary to control the struggles of the "jag," and thus prevent self-injury before he loses consciousness. The after-effects of such a case is usually a violent nausea and headache, and an extreme distrust of the gasoline engine. The use of heavy oil fuel has removed the source of danger from submarines and has made it possible to keep the engine room air good and clean in all conditions of weather.

Before leaving the question of mobility, it will be well to point out that submarines and submersibles have about the same qualities as surface craft as regards handling under various conditions, and as regards towing. Submarines may be towed with their crews aboard at speeds up to twelve (12) knots, the reliability of the operation depending only on the reliability of the towing apparatus. They may be submerged with absolute safety in all conditions of weather. In heavy weather they may be sealed up, that is, all hatches battened down, and navigated with absolute safety from the conning tower. Under such conditions, the air necessary for the engines and the crew is drawn into the boat through a ventilator controlled from inside the boat.

INVULNERABILITY.

In comparing the invulnerability of the submarine with that of the battleship, we find that where the battleship has armor whose resisting qualities are always more or less doubtful, the submarine has complete invisibility until within torpedo range, and after arrival within range has only two very small periscopes momentarily exposed over a hull about twelve (12) feet under the surface. The difficulties of hitting such a small moving target are great, and it must be kept in mind that the submarine at this stage of the action has already fired her torpedoes and inflicted her damage. There is no accurate information at hand to show the effect of firing a large shell at a hull submerged about ten (10) or twelve (12) feet, but recent experiments in England show that a submarine anchored with the hull about ten (10) feet below the surface can be sunk by heavy gun fire at comparatively short ranges.

OFFENSIVE STRENGTH.

The offensive strength of a submarine lies in her ability to maneuver submerged to within easy range of a surface vessel, and then to fire torpedoes without being subjected to a dangerous fire from her enemy. The surface vessel has no defense against the submarine, except her speed in running away, and in doing this she may be running directly into the danger zone of another group of attacking submarines.

The steady development of the torpedo together with the gradual improvement in the size, motive power, and speed of submarine craft of the near future will result in a most dangerous offensive weapon, and one which will have a large part in deciding fleet actions. Even at this present day it is impossible for an enemy to blockade a port protected by submarines, and decidedly dangerous to even attempt operations anywhere along the coast where it is known that submarines are employed in the coast defense.

SUBMARINES AND SUBMERSIBLES.

The hull of the submarine is generally of the spindle form, the cross sections being circles. This form of hull gives greater strength for equal weight of scantling, and is the form best adapted for submerged speed. With this form of hull, however, the maximum surface speed is reached when running at about fifteen (15) knots. The reserve buoyancy of the submarine when light is about twenty (20) per cent of the total displacement. The submersible has a "ship-shaped" form of hull, that is, its hull has more nearly the form of a surface torpedo boat. The surface speed of the submersible can easily be made high enough to enable it to accompany a sea-keeping fleet of battleships, whereas its submerged speed will fall about twenty (20) per cent below a submarine of equal size. The submersible having a reserve buoyancy of about sixty (60) per cent is apparently a better sea boat than the submarine. The submersible with its "ship shape" hull cannot be built with the same strength as the submarine, and where submarines are built to stand a submergence of two hundred (200) feet with safety, the submersible is guaranteed only to depths of one hundred and fifty (150) feet. It would seem then in order to obtain groups of sea-keeping submarine craft, it will be necessary to adopt the "submersible" type.

The relative advantages and disadvantages of the two types are given as follows:

SUBMARINE.

ADVANTAGES.

(a) Greater submerged speed and strength.
(b) More torpedo tubes in bow due to blunt form.

DISADVANTAGES.

(c) Less habitability due to reduced buoyancy and sea-keeping qualities.
(d) Lower surface speed due to poor form of hull.

SUBMERSIBLE.

ADVANTAGES.

(e) Greater surface speed.
(f) Greater habitability and sea-keeping qualities.

DISADVANTAGES.

(g) Reduced strength and submerged speed.
(h) Fewer torpedo tubes in the bow due to fineness of form.

As regards control on surface and submerged, the two types are practically the same. The submerged radius of action of the submersible is slightly less than that of the submarine, while its radius of action on the surface is slightly greater.

MODERN TYPES OF SUBMARINES AND SUBMERSIBLES.

The accompanying plate, Figs. 2 to 8, taken from *Engineering*, by permission, shows a modern submarine of the following approximate dimensions:

Length	150 feet.
Beam	15 ft. 6 in.
Displacement (surface)	390 tons.
Displacement (submerged)	520 tons.
Buoyancy percentage of submerged displacement	25 per cent.
Buoyancy percentage of surface displacement	33 per cent.
Surface speed	14½ knots.
Surface cruising radius	4500 nautical miles.
Submerged speed	10½ knots.

Submerged radius	120 nautical miles.
Safe depth of submergence	200 feet.
Armament	4 torpedo tubes and 8 torpedoes.

Figs. 9 to 14 on the accompanying plate show a modern submersible of the following approximate dimensions:

Length	212 feet.
Beam	21 feet.
Surface draft	12 feet.
Surface displacement	650 tons.
Submerged displacement	950 tons.
Buoyancy percentage of submerged displacement	31½ per cent.
Buoyancy percentage of surface displacement	46 per cent.
Armament	8 torpedo tubes.
Surface speed	17 knots.
Submerged speed	11 knots.
Surface radius of action	5000 nautical miles.
Submerged radius of action	140 nautical miles.
Safe depth of submergence	150 feet.

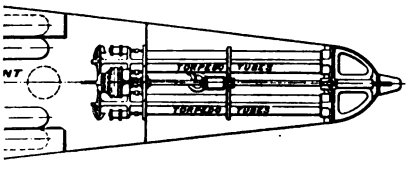
The submersible herewith is similar in many details to those built in France from the designs of M. Laubeuf, and in Italy from the designs of Major Laurenti.

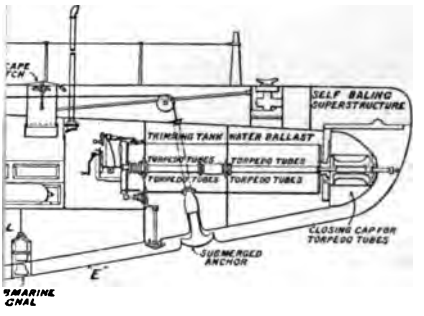
TACTICS OF SUBMARINE CRAFT.

Definitions are here given to the terms "light" condition, "awash" condition, and "submerged" condition.

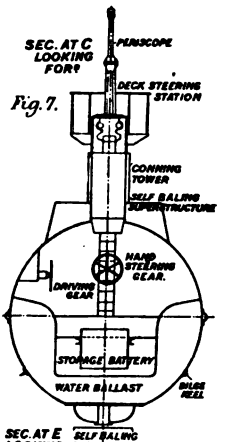
A submarine in the "light" condition has all of its water ballast tanks empty, and has its cruising bridge rigged. With the present form of cruising bridges, it is estimated that at least twenty minutes will be required to trim down to the submerged condition. In the new boats, however, folding bridges are under consideration which will require much less time to strike down.

A submarine in the "awash" condition has only those water ballast tanks empty which are habitually kept full when running submerged. The fore and aft trimming tanks and two smaller tanks, called the auxiliary and adjusting tanks, are filled with just enough ballast so that when the main ballast tanks are filled, the boat will be immediately ready for running submerged without further adjustment of ballast. The quantity of water in the trimming tanks and in the auxiliary and adjusting tanks, in the

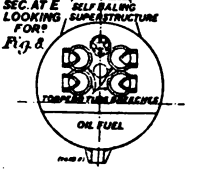


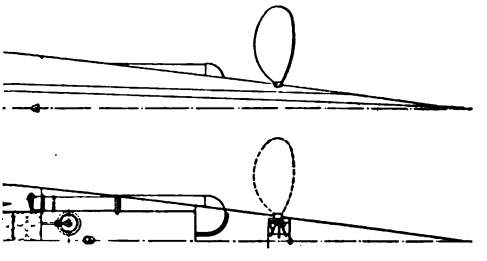


SEC. AT C LOOKING FOR?
Fig. 7.

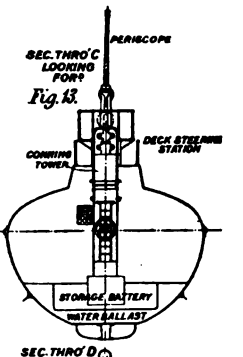


SEC. AT E LOOKING FOR?
Fig. 8.

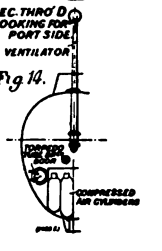


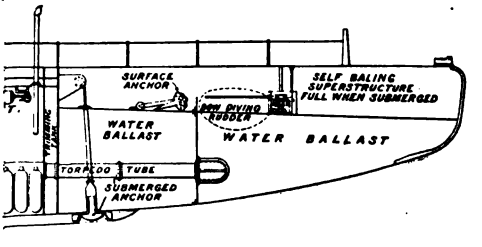


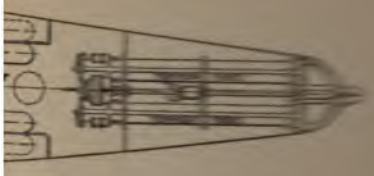
SEC. THRO' C LOOKING FOR?
Fig. 13.

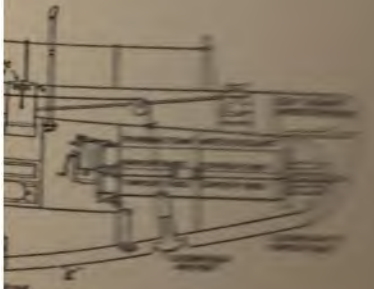


SEC. THRO' D LOOKING FROM PORT SIDE.
Fig. 14.









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"awash" condition, is so small in comparison with the total ballast, that for all practicable purposes the submarine has the same stability and safety as when running "light." In the "awash" condition a small section of bridge may be kept up for the lookout, and the conning tower hatch may be kept open and the radio rigged. It is estimated that five minutes will be required to trim down to the "submerged" condition from the "awash" condition. If any fuel is used while in the "awash" condition, the additional necessary weight can easily be computed and added to the trimming tanks. In time of war all submarines on station should habitually remain in the "awash" condition.

A submarine in the "submerged" condition has its ballast tanks and other tanks so filled that there still remains a small reserve of buoyancy (0 to 800 lbs.) and is all ready to run submerged.

TACTICS.

For the purpose of tactics submarines may be divided according to their capabilities into three classes, viz., harbor defense, coast defense, and sea-keeping offensive submarines.

Taking into consideration the capabilities of the harbor defense boats, this class should be sent to the Philippines, where the areas of defense around such strategical points as the entrance to Manila or Subig bays are comparatively small. Four of this class are now in commission in Manila Bay, two are in commission on the West Coast, and four are in reserve in Charleston, S. C. The five new boats of this class are admirably adapted for the defense of either end of the Panama Canal. For the protection of the harbors on the East and West coasts of the United States, there should be a group of five submarines and one suitable tender stationed at each of the harbors and places which are considered worthy of protection for strategical reasons. There are now only twenty-four submarines available for this purpose, and it is estimated that for the proper protection for the East and West coasts of the United States, there should be a total of fifty-five submarines on the East Coast, and a total of forty-five submarines on the West Coast. These submarines should be based on mobile tenders located as follows, one group of five boats operating from each base:

EAST COAST.

Bar Harbor, Me.
Portsmouth, N. H.
Gloucester, Mass.
Provincetown, Mass.
Point Judith Breakwater.
New York, N. Y.
Delaware Breakwater.
Norfolk, Va.
Charleston, S. C.
Key West, Fla.
Pensacola, Fla.

WEST COAST.

Port Townsend, Wash., two groups.
Columbia River, Ore., two groups.
San Francisco, Cal., two groups.
Santa Barbara, Cal., one group.
San Pedro, Cal., one group.
San Diego, Cal., one group.

As stated before, there are now twenty-four (24) submarines built or building, and a total of one hundred (100) are required to form a complete chain of defense about the great harbors and cities of our country. No mention has been made of the submarines for the defense of our over-sea possessions, such as Guam, Hawaiian Islands, etc., but it is believed that a mobile tender with a group of five (5) submarines will most effectually prevent the operations of a hostile fleet in these waters.

The tactics of a group of harbor defense submarines are extremely simple. Their limited submerged radius and speed will not enable them to operate far from the entrance of the harbor which they are protecting. The lack of reliable under-water communication makes it impossible to change plans of action once the group is submerged, without giving the enemy a clue as to the submarine's whereabouts. The argument might here be made that the enemy must know that certain harbors have submarines for their protection, and that a prudent enemy would not venture to attack such a place, and that the submarines would thus accomplish their object without further effort. That might be true enough, but there are always enough commanders of the "damn

the torpedoes and submarines " type who would take the risk, and it is for such kind that arrangements must be made. Any form of under-water signalling device at use in the present time can be accurately located in direction by the enemy. This apparatus for locating the direction of submarine signals is installed on practically every modern ship. So, for this reason alone, must the detailed plans for a group of harbor defense submarines be made explicit enough to cover every phase of an attack by a determined enemy.

Each boat of a group must be assigned a certain area outside of the harbor, which will be its zone of defense, these zones to be so selected that all approaches to the harbor are protected, and to be at such a distance from the point of defense that the enemy will never come within gun range. Most of our harbors lend themselves naturally to such a method of defense by the form of the channels leading to them, or by the presence of islands in the vicinity. A harbor defense group, having received warning from scouts or shore stations, of the movements of the enemy off the coast, immediately proceeds to the entrance, leaving the tenders inside the harbors. Submarines anchor in the " awash " condition, radio up, in the centers of their zones and keep a lookout for the enemy. By sub-dividing the total area outside each harbor into numerous small squares and using short code words to designate squares and directions, our scouts in touch with the enemy can easily keep the waiting group of submarines informed as to the enemy's movements. This method was successfully used last summer in the combined maneuvers off Block Island, and had the waiting submarines been equipped with radio, the results would have been even better than they were. As it happened last year, the submarines were dependent upon a fast scout to come from an inner scouting line and give information by signal or megaphone to the submarines in their zones. The waiting submarines having ascertained definitely, or in all probability that the enemy will pass close to their harbor, immediately get up their anchors, lay down their radio masts and submerge as soon as smoke appears on the horizon. With a moderate amount of their periscopes exposed a submarine can easily see a large ship in clear weather for a distance of seven or eight miles. During maneuvers in Long Island Sound with the U. S. S. *Dixie,* her masts and smoke were easily seen from the *Snapper's* (C-5) periscopes at a distance of nine

miles, with about four feet of periscopes exposed. The submerged group, each boat in its zone, remain stationary until the movements of the hostile fleet are definitely ascertained. By the arrangement of the zones, the enemy must pass close to one submarine; the other boats must then move over towards the enemy at such speeds and with just enough periscope exposure to enable them to get within torpedo range without detection. Once within torpedo range they keep their periscopes exposed and make all speed possible to get within easy torpedo range to fire their torpedoes at that part of the enemy's formation previously assigned to them. In this last maneuver they must act regardless of their other boats, and must take the risk of collision. On this final charge, the submarine bells may be rung continuously to assist the submarines to keep clear of each other. Having fired their torpedoes, the boats submerge totally, and reload their tubes if they have spare torpedoes. During the period of reloading they may run at such depths as would enable them to pass under the enemy's vessel, or if the depth of water permits, they can rest on the bottom until the reload is finished, when they should return to the surface to inflict such further attack as is possible. A submarine having exhausted her supply of torpedoes has still a most formidable weapon in her ram. That this weapon is most efficacious and without danger to the crew of the boat was proven in the fall of 1910, when the C-4, at a comparatively low submerged speed rammed the tender *Castine*, causing her to settle immediately. There can be no doubt that the torpedo properly adjusted, and used with the short ranges possible in harbor defense, will be effective. There are even instances on record where torpedoes with exercise heads have seriously damaged the hulls of vessels by the force of impact.

The harbor defense group having exhausted its means of offense should return to the tender, submerged, if necessary, or under cover of darkness, to replenish torpedoes and storage batteries.

For the night defense of the harbor, submarines remain on the surface in their zones, being used in this manner most effectively as surface torpedo boats. The tactics on the surface as torpedo boats are similar to the tactics employed in surface torpedo craft, and as they are well known to the service, they need not be described here.

COAST DEFENSE SUBMARINES.

The distinction between a coast defense and a harbor defense submarine lies in the greater submerged and surface endurance, the greater submerged and surface speed, and the better habitability conditions of the coast defense boat. Considering the most inferior of our present coast defense submarines, we find that they have been making cruises up and down the coast as far south as Norfolk, Va., and as far north as Gloucester, Mass.

Our government on account of the general topography of its coast should not build any more strictly "harbor defense" boats. A "coast defense" group will accomplish with greater effect the same duties that are now accomplished by the harbor defense group. Countries in Europe are so close together that smaller submarine craft and more of them are of greater military value than fewer and larger submarines. Our general policy of submarine construction should not be too greatly influenced by the building programs of European nations. Ours is a separate and distinct problem.

In considering the tactics of a group of "coast defense" boats, it is assumed that information has been received from reliable sources, scouts or shore stations, that the enemy's fleet is approaching our coast with the evident intention of seizing a base or of landing a force. The group proceeds at its highest reliable surface speed in column in the "awash" condition, with radio up, to intercept or to come in contact with the enemy. The submarine with its low hull can easily distinguish the masts and other characteristics of a vessel when the submarine cannot be seen at all. On sighting the smoke or masts of the hostile fleet, and having approximately determined his course, the entire group immediately submerges, after rigging down the radio, and proceeds submerged at about one-half mile distances in the general direction of the enemy at such speeds and under such general directions as may have been previously issued by the group commander. The submarine group, submerged at one-half mile distances can easily keep clear of each other. They must then maneuver to keep a position on either bow of the enemy's column in order to insure their getting within torpedo range before being sighted. This approach must be made totally submerged, with an occasional "porpoise" or periscope exposure of short duration.

When within torpedo range periscopes should be exposed enough to keep an easy bearing on the enemy, and the speed increased as much as possible to arrive within "easy" torpedo range (between 500 and 1000 yards) before the enemy has time for a concerted maneuver. Each submarine fires its torpedoes at the parts of the formation previously agreed upon, totally submerges, reloads as soon as possible, and returns to the attack. The following sketch to scale shows the most favorable condition under which a group

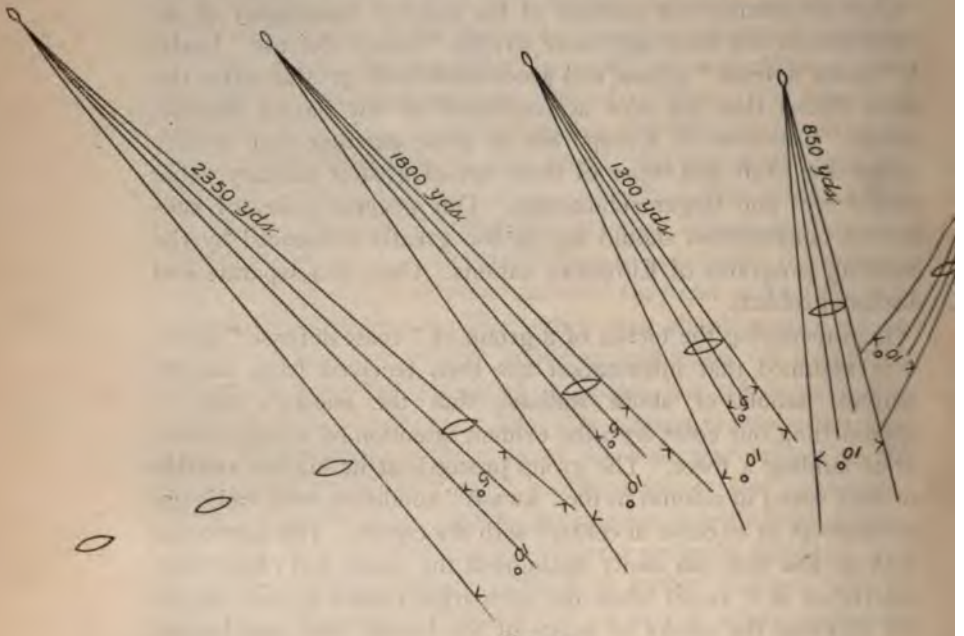

FIG. 2.

of submarines in contact with the enemy can fire their torpedoes. Using torpedoes, capable of angle fire, a four-tube boat should set one torpedo to run five degrees to port of her keel, two to run straight ahead, and one to run five degrees to starboard of her keel.

The movements of each individual boat in contact with the enemy will be dependent on the enemy's formation. Tables showing the proper bearings on which to fire torpedoes with maximum chances of hits, have been compiled for every formation and are readily understood by submarine officers. It is not expected that

every shot will be a hit, nor that every ship of the enemy's force will be disabled. It is hoped that, however, with the above method of firing enough damage will result from the discharge of 20 torpedoes to prevent the enemy from accomplishing his purpose. Attention is also invited to the fact that with accurate knowledge of the enemy's whereabouts off the coast, two or more groups may be despatched to the probable destination of the enemy to deliver an attack as shown above. Under such a condition the other group should attack other parts of the formation. Submarine groups, having exhausted every means of offense, including the torpedoes and ram, should withdraw submerged at low speed or lie on the bottom, if that is possible, until nightfall and then return to the base of supplies under cover of darkness, charging their storage batteries on their way into the base. All attacks so far have been assumed at a moving enemy. Should the attacking group discover the enemy at anchor, landing troops or establishing a base, they should continue as above outlined, totally submerged with only an occasional "porpoise" of short duration until well within torpedo range, when the periscope should be kept submerged until the torpedoes are fired at easy ranges at prearranged parts of the enemy's formation. No special difficulty is anticipated in passing the line of enemy's scouts or pickets with the submarines running totally submerged with occasional "porpoises."

It must be understood that after the reload of torpedoes, the submarines must act absolutely independently, and that it is impossible with the present lack of underwater signal facilities to communicate. In all cases the chief duty and aim of the group commander must be to bring all of his group *into contact with the enemy and within torpedo range at the same time.* Having done this, it is up to the individual commanding officers to produce the desired results.

TACTICS OF AN OFFENSIVE SEA-KEEPING GROUP OF SUBMARINES.

It is not within the province of this discussion to determine the exact tonnage and horse-power of a "sea-keeping" submarine. That information can only be obtained by actual experience in running a group of submarines with a fleet engaged in active war maneuvers. No amount of computation of the number of cubic

feet of space necessary for each person on board will suffice. A "sea-keeping offensive" submarine may be defined as a submarine which can keep the sea, ready for duty under all possible conditions of weather for indefinite periods. Such a submarine group could obtain its supplies from vessels of the fleet which it accompanies, and be in every respect as mobile as any unit of the fleet.

The tactics of such a submarine group after contact with the enemy will be the same as the tactics already described for harbor defense and coast defense submarines in contact with the enemy. The problem of maneuvering such a group into contact with the enemy, or to more accurately state the case, the problem of maneuvering the enemy's fleet into the "submarine danger area" must be solved by the commander-in-chief.

As an illustration of the use of one or more offensive submarine groups accompanying a fleet, let it be assumed that the submarines have a surface speed capable of cruising with the fleet at any speed that may be required to keep up with the fleet. Let it be also assumed that the submerged speed and the radius of the submarines is about twelve knots for one hour, or about eight and one-half knots for four hours, or about five knots for fifteen hours. These assumptions are not excessive. Suppose also that in the cruising formation submarine groups take position on either flank of the fleet. The submarine groups are in the "awash" condition ready for instant use. The commander-in-chief having received information from his scouts of the presence of the enemy, or having sighted the enemy, should immediately send his submarine groups "awash" off on a bearing previously decided upon, and then endeavor to maneuver his opponent into the area occupied by the submarines. The submarines may remain "awash" until the enemy's smoke or masts are sighted. If our commander-in-chief possesses a superior speed he can choose his own situation, and having patience can eventually bring the enemy into the submarine area. If our commander-in-chief possesses the inferior speed he may be forced into action before bringing the enemy into the submarine area. In this case submarine groups should maneuver "awash" or "submerged," as is necessary to keep out of the enemy's sight and endeavor to attack the enemy's formation as soon as possible without interfering with the movements of the commander-in-chief. If our commander-in-chief has the inferior speed and inferior force, and if the enemy is determined to bring

about an action, the problem of making him cross a submarine danger zone is greatly simplified. The appearance of several groups of submarines within or very close to his formation just before a general gun action would undoubtedly cause the enemy to so alter his plans and formation that he would be at a temporary disadvantage, and at the mercy of our fleet. Even if all the torpedo shots missed, the effect on the morale of the enemy would be sufficient to give our commander-in-chief a temporary advantage. Most of the important fleet actions have been fought in sight of land or close enough to shoals to cause the movements of the vessels in action to be somewhat restricted as to courses. In cases of this character the commander-in-chief can so station his submarine groups as to increase the chances of forcing the enemy into the submarine danger area. The commander-in-chief must make a careful study of the areas in which fleet actions may be anticipated in order to utilize to their maximum value the capabilities of the submarines in his fleet. If the commander-in-chief desires to withhhold the submarine attack until after the gun fire, the submarine group should be kept in the background within easy radio signal distance, but in doing this, the commander-in-chief must realize that it will be more difficult for the submarine groups to make a successful dash across the space between the engaged fleets, due to the inferior submerged speed of the submarines. Ships of the enemy that are already disabled would in such cases become easy prey for the submarines. Submarine groups accompanying a fleet are decidedly offensive weapons and of the greatest value when used just preceding a general gun action.

A ruse which might assist in forcing the enemy to keep away from certain areas and thus increase the chances of making the enemy cross the submarine danger zone would consist of having the fast scouts of the fleet drop numerous poles, properly weighted, to float upright in the water, and painted to look like a submarine's periscope. These same dummy periscopes floated out of a harbor with an ebb tide or dropped outside by scouts or fishermen may greatly influence the movements of an enemy sighting them. It would be extremely difficult to distinguish between dummy and real periscopes, for it is easy for a submarine to lie submerged and stationary with only a small amount of periscope showing.

The night maneuvers of submarine craft are the same as for surface torpedo craft, and the same tactics should apply. As there is no possibility of "torching," and as the hull is so low in the water, it is extremely difficult to pick them up at night, even in the full rays of the searchlight. The maneuvers off Provincetown in the summer of 1911 demonstrated that in nearly every case the submarines could come within easy torpedo range of the enemy at night without detection. In a night attack submarines should remain in the "awash" condition, so that in case of self-preservation, or to pass through a picket line, the submarine can quickly run submerged.

RECOGNITION SIGNALS.

At night submarines on the surface will use the same recognition signals used by all surface vessels of the fleet. During daylight operations the problem of recognition is much more difficult. At compartively short ranges, 3000 yards and less, the submarines submerged can recognize a friendly vessel by her silhouette, or at shorter ranges by certain flag or shape signals shown from specific parts of the surface vessel. If surface vessels are fitted with submarine signal apparatus, code recognition signals may be sent, using the bell within the limited distances mentioned in this discussion. By properly screening a submarine bell it is quite possible to send the sound waves out on a line of bearing, or at least within a very small arc. However, in the absence of the submarine bell the battleships or surface vessels must rely on their flag or shape signals to make themselves known as friends. The submarine has only two methods of recognition signals at her disposal, one, sounding code words or letters on her bell, and the other, carrying a certain shaped flag or pennant on her periscope. It would seem that the submarine bell methods would be more efficient at greater distances than the other method, but it has the disadvantage of warning friend and foe alike of the presence of submarines. From a submarine officer's point of view it would seem far better to trust to the judgment of the commanding officer of the submarine to recognize friendly vessels, which he could most certainly do from a silhouette diagram at comparatively long ranges. After recognizing a friend a submarine may rise to the surface and exhibit surface recognition signals, if such are necessary. This method, however, might endanger the submarine

before she is recognized as a friend. The submarine officer desirous of getting within easy torpedo range would be very loath to disclose his bearing to a probable enemy by sounding his bell.

A logical and fairly accurate answer to all points under discussion can only be found by continuous combined battle maneuvers, using all the necessary units of a fleet.

Rundschau

SUBMARINE CRUISING ON SURFACE MAKING A TURN.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE STRATEGIC NAVAL WAR GAME OR CHART MANEUVER.*

By CAPTAIN W. MCCARTY LITTLE, U. S. Navy.

1. MOTTO: "NECESSITY IS THE MOTHER OF INVENTION."

If it were not for the stimulus of necessity, all effort in the world would stop, and the universe would come to an end. Therefore if we want to spur up action, and the *real* necessity is not available, we must create an *artificial* one.

"Assume a virtue if you have it not."

2. THE NAME "WAR GAME" *vs.* "CHART MANEUVER."

In embarking on this lecture I would like to say, by way of preface, that the name Game, *War Game*, has had much the same depreciating effect as the term *Sham Fight* has had with regard to field maneuvers. To avoid this the army has had recourse to the expression *Map Maneuver*. We, of the navy, may in like manner say *Chart Maneuver*, and we have lately decided so to do. There is a further reason why it is well for us to prefer that term, namely, that it accentuates the fact that the strategist's real field of operations is the chart, just as the architect's real field is the drawing board; indeed, Jomini calls Strategy "*War on the Map.*"

Still, war itself has been declared to be a game, and rightly so, for it has the game characteristic of the presence of an antagonist. It has, however, another characteristic which differentiates it from most other games. The latter are played for sport; and good sport requires reasonable chances of winning for each side, and aims to give amusement even to the losers. In the game of war, on the other hand, the stake is life itself, nay, infinitely greater, it may be the life of the nation, it certainly is its honor. We are

* A lecture delivered at the Naval War College.

its champions; what sort of a figure shall we cut when, at the tournament, the trumpets sound the charge, and it is found that we have neglected to practice in the joust. What fencing is to the swordsman, what the jousting field was to the knight, the war game is to the modern strategist; and I hope to show that it is even a great deal more.

3. NATURE OF GENIUS.

For many years it was believed that good shots were born, not made; and it is only quite lately that this fallacy has been laid bare. So, too, has it been very generally held that the skill which wins wars was a gift from above.*

That we could apply the same methods to the acquirement of skill in conducting war that we use in learning to play marbles or football does not seem generally to have been suspected.

Marshal Soult said, however, that "that which is called an inspiration is simply a calculation rapidly made"; and another great authority has said that "inspiration was frequently but a timely recollection," which is but a paraphrase of the saying that the "soul of wit is apt quotation."

Napoleon has himself revealed to us what is to be thought of *his* innate genius, when, in a conversation with Senator Roederer, the 6th of March, 1809, he said:

> As for myself, I am always at work, I meditate a great deal. If I seem always prepared to reply to all, to meet all, it is that before undertaking anything, I have meditated a long time, I have foreseen what might occur. It is not a genius which reveals to me suddenly, in secret, what I am to say or do in an emergency by the rest of people unexpected—it is my reflection, it is my meditation. I am constantly at work, at meals, at the theater; at night I get up to work.

The distinguished French military writer, from whom the above is quoted,† General Pierron, in an attempt to ferret out the secret of Napoleon's wonderful military capacity, has discovered that the main points of his most brilliant campaign, the campaign in Italy of 1796, were taken from the Memoires of the Marshal de Maillebois, who had commanded in that theater fifty years before

* Of course we are speaking here of skill, and not of natural aptitude for acquiring skill, which is quite another thing.

† Comment s'est formé le Génie Militaire de Napoléon 1^er^, by General Pierron.

(1746), and from a paper of General de Bourcet, in which there is a review of operations in Italy in 1733.

It is not generally known that before assuming command of the Army of Italy, Napoleon had previously served in the same army as chief of artillery, and from there was transferred to the general staff in Paris, where he prepared a plan of campaign for that army, at which time he saw the books referred to.

In a conversation on this subject the late Major Churchill of the army related the two following stories in illustration:

An officer who had served on the staff of General Sherman in the March to the Sea, was telling Major Churchill of the General's wonderful, intuitive grasp of terrain, and gave as an example how one day the General was laying out the order of march, and said such a column will ford the Chattahoochee at such a point."—"General, there isn't any ford shown on the map; hadn't we better send a reconnoitering party to find out?"—"Oh, no; I'm sure they will be able to find a ford there somewhere," and sure enough they did!

Then the Major laughed; for he remembered that when he was a boy accompanying his father, Colonel Churchill, who was conducting the survey of that section, Lieutenant Wm. Tecumseh Sherman, of the third artillery, reported for duty, and that Lieutenant Sherman and he had crossed that ford together many a time!

The other story was that a man was insisting on the intuitive, inborn instinct of sign reading possessed by the Indians. "Oh, said his companion, "the white man could do the same under proper training."—"Never, never in the world!"

Just then the rattle was heard of an ice cart passing in the street. "What's that?"—"That's an ice cart."—"How did you know that? An Indian would have thought that wonderful."

4. SCIENTIFIC MANAGEMENT.

We all know how in the early part of the last century Germany set industriously to work with all the national thoroughness to apply what it is to-day becoming fashionable to call "scientific management" to the solution of the problem of conducting war.

5. THE KRIEGSSPIEL.

In 1824 Lieutenant v. Reiswitz, of the Prussian Artillery, adapted to the purposes of serious military instruction and investigation a game of war invented by his father; and we read that soon after this v. Moltke was president of a society to play the game. This shows that v. Moltke early became awake to its great importance. When in 1866 Prussia, out of half a century of peace, overthrew the power of Austria in a six weeks' campaign, and, four years after in a struggle with France who had had the benefit of the experience of several wars, succeeded in rolling her antagonist in the dust, the world realized the value of systematic scientific training; and it was generally admitted that the war game was a notable factor in the result.

There were a few French officers, just previous to 1870, who had sounded the alarm; but they were pooh-poohed in the way more or less familiar to us; while Marshal LeBoeuf, the French commander-in-chief, told the emperor that the army was ready—"jusqu 'au dernier bouton de guêtre,"—to the last gaiter button.

There is perhaps more in this answer than at first appears, for it would seem to suggest that his mind, much like that of many naval officers of recent years, was more centered on the materiel, than on the "management."

So, when the time of mobilization arrived, there was confusion worse confounded, much like the later experience of other nations who were not warned by the "horrible example."

The war game being thus brought prominently to view, naval officers began to ask themselves if the game could not be adapted to naval use; and thus began the movement which led to its being now generally adopted.

6. CLERK'S ANTICIPATION OF AND USE OF THE WAR GAME.

Although the use of the war game to-day in the navy was suggested by the German Army Kriegsspiel, brought prominently to view in 1870, yet it is true that, in the latter part of the eighteenth century, Clerk, "The Laird of Eldin," made use of what was practically the same thing for his solution of the tactical problem of his time, as we may see from the following extracts from the Introduction to Clerk's Naval Tactics:

"The splendid results which followed Mr. Clerk's discoveries in naval tactics sufficiently attest their value and importance. The publication of his theory forms indeed an era in the annals of maritime war. If we look to the battles which were fought prior to this, we find, notwithstanding the valor and enterprise both of our officers and seamen, that, with few exceptions, they were all indecisive and unprofitable. The object of our enemies, conscious of inferiority in close action, was to avoid battle, and to act entirely on the defensive; and for this purpose they had brought to perfection a system of skilful maneuvers, by which they always contrived to disable and keep at a distance the hostile fleets of Britain.

"Hence the British commanders were always foiled in their attempts to force on a close action; and though they often encountered the enemy's fleets, they generally parted, after some indecisive and distant cannonades.

"The simple, bold, and decisive maneuver of passing through the enemy's line, suggested by Clerk, and of which he demonstrated the efficacy in a variety of the most conclusive illustrations, effected a complete revolution in maritime war, and gave a new and brilliant aspect to our naval history. The conflicts of hostile fleets were no longer signalized by the triumph of defensive tactics. The skilful mode of attack now adopted never failed to bring on a close and general action, in which valor was sure to triumph; and since this period accordingly, a succession of the most brilliant victories has adorned our annals."

Mr. Clerk in his preface says:

As I never was at sea myself, it has been asked, how I should have been able to acquire any knowledge in naval tactics, or should have presumed to suggest my opinion and ideas upon that subject. The following detail, which I trust I shall now be excused from entering upon, will, it is hoped, obviate every prejudice of this kind.

In the course of this explanation and speaking of his study of Byng's Action, he says:

The attack in this battle (Byng's Action) was from the windward: and as it appeared to me extremely ill conducted, the subject occupied my mind for years. In this discussion, I had recourse not only to every species of demonstration, by plans and drawings, but also to the use of a number of small models of ships which, when disposed in proper arrangement, gave most correct representations of hostile fleets, extended each in line of battle; and being easily moved and put into any relative

position required, and thus permanently seen and well considered, every possible idea of naval system could be discussed without the possibility of any dispute.

and further in reference to the war then in progress:

In the meantime, so often as dispatches with descriptions of these battles were brought home, it was my practice to make animadversions, and criticize them by fighting them over and over again, by means of the aforesaid small models of ships, which I constantly carried in my pocket; every table furnishing sea-room sufficient on which to extend and maneuver the opponent fleets at pleasure; and where every naval question, both with respect to situation and movement, even of every individual ship, as well as the fleets themselves, could be animadverted on; in this way not only fixing and establishing my own ideas, but also enabling many landsmen to form a judgment with respect to the subject of tactics as well as myself.

There are for us in these quotations two interesting points:

(1) That a civilian, feeling that there was some reason, not then known, which should account for the want of success to English arms, deliberately set himself to work to find out the reason; succeeded in discovering that what the English admirals had considered as French defeats, were actually successes of the French tactical scheme; succeeded in finding out what that scheme was; and finally sought out, and succeeded in devising plans to break it up, and bring about the destruction of the enemy; . . . and these proved not only plans, but plans which brought overwhelming success.

(2) That to accomplish this he used little blocks representing ships which he moved about on a table representing the sea: practically the naval tactical or fleet war game of to-day!

Here we have before us in this book the successful solving of an important problem of war. The value to us is not so much in the solution itself, which was for a case under very different conditions from those which we now see; but in the fact that we have before us a successful method of solution.

The method stands, both method and appliance.

(The Department should reprint this book, and it should be carefully studied by every officer as a text-book on the method of solving tactical problems.)

7. OBJECT OF THE NAVAL WAR GAME.

The object of the naval war game is to afford a practice field for the acquirement of skill and experience in the conduct or direc-

tion of war, and an experimental and trial ground for the testing of strategic and tactical plans.

The game offers the player the whole world as a theater, and puts no limit to the forces either in numbers or kinds. Any type of ship may be had for the asking, the only requirement being to state its qualities so they may be expressed in game convention. The ships, too, can do what in time of peace is impracticable to the real ships—for example, they can ram the enemy or destroy him with gunfire; they can run all sorts of risks, nay, can be destroyed to prove the inefficacy of a poor plan, and in a twinkling they can be restored for a new trial. And all of these things are at the disposal of any group of officers gratis.

It is unnecessary to call attention to the fact that the real fleet is not at the free disposal even of its own admiral.

While we can give an entire forenoon, if necessary, to work out and analyze a five minute critical movement, we can, on the other hand, dispose of a day, or week, or a month in less than an hour.

After this rehearsal of some of its advantages, it must be admitted that it has facilities greatly in excess of the fleet.

7. "WAR ON THE MAP" COMPARED TO "SAILING ON THE CHART."

Now at first blush it may be a little startling to be told that for the conduct of a naval campaign the presence of the fleet is not necessary. Strategy has been called, as we have seen, *War on the Map*. A little consideration will show that ordinary navigation is merely *sailing on the chart*. A walk on deck gives no idea where the ship is, but a glance at the chart in the cabin does. In like manner it is on the chart that the admiral plans and conducts his cruise.

Even on the *tactical field* with the enemy in sight, the picture on the retina is a distorted representation, which in the mind must be reduced to a proper diagram. The adjoining ship seems large; those further away diminish in proportion to distance; speed across the line of vision seems very great; that along its direction comparatively slow. Even the actual witnesses to a battle do not have a clear idea of what has taken place until it has been reduced to a diagram.

9. JUSTIFICATION OF TACTICAL GAME BOARD'S BIRD'S EYE VIEW.

It has been sometimes objected that it is a mistake to permit the tactical game board to be seen as though from an aeroplane; but the reason why we recognize a friend a couple of miles away is because we know him so well that the slightest indication will suggest all the rest. Therefore it was thought best to train first with a full view, and later to apply the handicap of obstructed vision, just as a chess player would practice first with the board in sight before undertaking to play blindfolded.

10. GENERAL DIVISIONS OF THE GAME.

It may be said that War is, in the theater of operations, to hunt the enemy and fight him; Strategy, to hunt the enemy in order to fight him; and Tactics does the fighting.

Similarly, that Battle is, on the scene of conflict, to seek position and strike; Tactics to seek position in order to strike; and Gunnery does the striking.

There thus appear to be two natural divisions of the game; The strategic game and the tactical game. As information and security cut a large figure in strategy, they form, in practice, the most important part of the strategic game. The handling of scouts and screens, ever ready to take touch with the enemy, has a strong tactical flavor, though the object is chiefly strategic. Since it is on the quick settlement of these contacts that the smooth running of the game largely depends, and since it is on the familiarity with the solutions of such contacts, and a confidence in what an admiral can expect from his subordinates in this respect, that his freedom of planning depends, the skilful handling of scouts and screens may well be made the subject of a class of games by itself. It is a sort of connecting link between the strategical and the tactical.

11. MUST LEARN TO THINK IN GAME CONVENTION.

Now, we must not overlook the fact that the game is a convention just as is the chart or printed page, or indeed language itself; and if we wish to use either, we must learn to think in it. The war game is a cinematographic diagram; and it is as important to us to be able to read it, as to read a chart or a book.

Before leaving this matter we must sound a warning:

The solutions of the game board, being mathematical, are necessarily correct, "errors and omissions excepted," as runs the commercial phrase; but they are dependent on the conditions. The real question is: are the conditions correct? Let us assume for instance a game ship that has certain stated qualities more or less like say the *Delaware*. The question, then, is not: "is this ship like the *Delaware*," but "is the *Delaware* like this ship?" And the reason is because we know positively and accurately what our assumed ship can do, but no one can state accurately what the *Delaware* can do—indeed no actual ship remains the same for any length of time.

12. How the War Game Leads to Seeking Solutions of War Problems.

Let us now follow through the various steps of the game and see how it leads us irresistibly to seek the solution of those problems which will face us when war makes its appearance. To this end let us start with a game of the first magnitude; and let us suppose that we desire to study a certain theater of war, and that we have selected the adversary best suited to our purpose.

The available players are divided into two camps, to one of which is assigned the blue, and to the other the red—the two colors usually used in the game to denote the sides.

A certain number, however, must be reserved for the umpire staff—consisting usually of the umpire, the recorder, an assistant umpire for each side, and, if desired, such other assistants as may prove convenient.

Since a war game is a numerical problem, and the solution is to be a numerical solution, it follows that the quantities involved must have assigned to them positive numerical values, in many cases unknown to the adversary. These values must consequently be fixed by the umpire, and are formulated in what is termed the *situation*, which *situation* states exactly the terms and conditions of the problem.

This statement of the "situation" is divided into two parts, sometimes called respectively the *General Idea* and the *Special Idea*, the General Idea being that part which is known to both sides, and the Special Idea, that which is known only to each.

There may be even a third part, known only to the umpire, as for example, when a given program of weather is to be followed; and of course the details could not be known to the players before the proper time.

Now, the very formulation of the problem compels a preliminary study of the question on the part of those who devise it.

The problem being delivered to the players, each side must make a careful study of the situation, must disentangle from the details of the statement the exact task that has been assigned to it to accomplish—the exact *mission* laid upon its shoulders, *i. e.*, just what it has to do. This first step is indispensable. The contemptuous expression of "that man doesn't know what he is about" exactly fits him who has not fulfilled this first step—who has not disentangled from the irrelevant accompanying matter, his exact mission reduced to, and expressed in, its simplest terms.

This done, the problem will already look much simpler.

But there is another point involved: namely, the exact demarcation and fixing of the limits of what we may call the *area of discretion*, the area within which we may use our judgment, and outside of which we may not go. This demarcation is of very great importance; and we have seen here at the College cases in which, from this first step having been neglected, the decision seriously arrived at, after careful consideration, was nothing more than a conclusion to obey the order received, instead of a decision as to how best to obey it, which problem had been entirely overlooked and untouched.

We then proceed to the second step: a consideration of the *difficulties* we have to encounter in accomplishing our mission. Now, these difficulties may be regarded under two heads—those interposed by nature, and those interposed by man, and they call for a study, under the first head, of the terrain or theater, and under the second head, of the enemy and what he can, and probably will do.

I venture to say that we shall have no trouble in agreeing that after this step has been accomplished, the problem will appear much less formidable than it did before, and the reason is because it is the unknown that frightens people to death.

Being now possessed of a good idea of what we shall have to meet, our third step is: to marshal our forces and see what *means* we have to overcome these difficulties; to marshal the various

lines of action opened to our choice, to compare these, weighing the advantages and disadvantages of each.

When this has been carefully accomplished, we shall find ourselves much nearer a state of readiness to take the fourth step—the selection of the best one of these courses of action, or, as the technical term is, the *decision*.

This process which is thus briefly summarized is known as the *estimate of the situation*, and is the first grand step in the game; and let it be noted that it is the war game that has led us to adopt this systematic method described. It was the game that sought the method, and not the method that sought the game.

13. ORDERS. SYSTEM *vs.* NO SYSTEM.

Now that we have decided what we will do, the next step is to issue the necessary orders to carry out our decision. The preparation of these orders brings us face to face with the fact that we have had no system of war orders at all.

The Germans, first players of the Kriegsspiel, under v. Moltke, developed order writing to a high degree, *under the direct stimulus of the war game;* and their system is now the model for all the world, or at least for those who have waked up to the importance of such a system.

Just as it was the Kriegsspiel that led Germany to this work, so has it been the war game that has aroused us to it.

The *campaign order* (called in Germany the *operations order*, and in our army the *field order*) is the subject of a special lecture by another officer,* so it is only necessary here to touch upon it very lightly; but we may state that the exhaustive study given to the operations order has shown that, reduced to its simplest terms, it consists of in its *body* a skeleton of five parts:

The first—the necessary, relevant information.

The second—an outline of the general plan with regard to the force as a whole.

The third—distribution of the work in regard to the working force.

The fourth—distribution of the work in regard to supply, etc.

The fifth—the place where the directing authority can be reached.

* See "Applicatory System of Solving War Problems" on p. 1011 of PROCEEDINGS No. 143.

14. ORGANIZATION *vs.* DISTRIBUTION OF FORCES.

When we come to distribute our forces to carry out our plan, we find that there are two distinct bases of organization: (1st) the natural tactical organization (technically termed "*organization*"), that which, independent of plan, groups the elements into such bodies as makes them easily manageable for administration, handling and assignment, as for example the ship, the division, the squadron, etc.; and (2nd) the organization under the plan, organization by task (technically termed "*distribution of forces*" in contradistinction to "organization," as limited above), as for example *advance scouts, advance screen, flank screen, main body, rear guard, train guard,* etc.

The word *forces* heads the margin which in the formal *combined order* is an abbreviation standing for this expression, *distribution of forces;* and the contents of the *margin,* where one is used, correspond exactly to the caste in the program handed to us in the theater, which gives the characters in the piece and the names of the actors assigned to each.

They are, then, as one might express it in the language of the stage, the characters in the play, the rôles of the plan. To each of these "rôles" or sub-tasks is assigned a suitable portion of the force, avoiding for reasons of administration any unnecessary splitting up of the tactical and administrative groups, indicating for each sub-task the officer responsible for its execution, and leaving him as free as possible in his way of action. This preserves the control of the ensemble, while giving the freest scope to the senior on the spot. Of course, to such sub-task leader, the task assigned to him becomes within *his "area of discretion,"* a similar problem, to be handled similarly to that already described.

15. FREEDOM OF ACTION TO SUBORDINATES.

The temptation for the commander-in-chief, when he has nothing to do in his own sphere of action, to interfere in the *area of discretion* of his subordinates, is very great, and is moreover very dangerous, because it tends to make the commander-in-chief believe that it is his proper business, it tends to dull in the subordinate his sense of responsibility, and, when the commander-in-chief really has got something of his own to do, it seriously, if not fatally, interferes with his freedom of mind properly to attend to it. The only cure for this is proper war game training.

In this connection, I quote from a lecture delivered October, 1910, at the Army War College by Captain W. L. Rodgers, U. S. Navy, not only for the very pertinent ideas expressed on the subject, but also for the testimony it brings on the invaluable influence of the war game. I quote:

Strategy and tactics are intimately bound up with organization and administration. Matters of organization are avowedly subjects of study here (A. W. C.); but administration, as it seems to me, is not acknowledged, although it is actually a subject of instruction in one particular direction where constant iteration must produce an effect in wider fields.

I allude to the map problems which professedly are tactical and strategic studies, but beside are daily made to teach the supreme administrative lesson of "minding one's own business."

Let us take the case of a regiment to assume outpost duties, and the problem is for the colonel to issue the order. If a solution undertakes to go beyond the battalion commanders and give directions to individual companies, the writer is sure to be reminded that he can command three battalions efficiently, but that twelve companies are too much for anyone. Similarly, if in a divisional movement, the divisional order lays down the movement of a brigade in too great detail, it is pointed out as a fault liable to entail disaster by depriving the brigadier of the discretion he ought to exercise.

Such errors as these just mentioned are not tactical ones, they are administrative faults producing tactical results. But as administrative faults they are not peculiar to the military profession, but are general in all classes of business.

Again, take the form of the *field order:* the first paragraph is devoted to information, the second outlines the general plan, the third and fourth distribute the work, and the fifth announces the place where the commander may be reached. Of these five paragraphs only the last is peculiar to the military nature of the order. The other four merely conform to common sense and the general principles of administration, and might be adopted for issuing an order to any business organization.

Indeed, even the fifth paragraph applies to ordinary business, as for example, where the director is called away from town or his office, and desires to leave some particular address at which, in case of necessity, he can be reached directly. The natural place for this would be at the end of the order.

For these reasons I am strongly of the opinion that the broad general principles of administration should be a subject of study here; and I have been much impressed with the great desirability of taking up the analysis and study of military administrative orders following the same lines as those of the field order.

If true of the army, it certainly is true of the navy.

It is very difficult for a superior to deny himself the privilege, which he necessarily has, of attending to as many details as interest him; but gratification in such a course is ruinous to efficiency. But as was said before, the remedy is not to alter organization so as to reduce the commander's right to meddle; the best course is to take away his desire to meddle by teaching him to know better, and that is what the map problems do for everyone who profits by them, and may be done in still greater degree by study of the principles of administration in general.

And later on in the lecture he writes, speaking of General Grant:

There is a vast store of administrative wisdom in his reply to Sheridan when the latter telegraphed him in the Appomattox campaign that Lee would surrender "*if things were pressed*," and Grant answered "*press things.*"

For a contrast, it is interesting to compare this order with that of Johnston for the advance on Shiloh. At Shiloh, everybody, including the commander-in-chief, was tactically tied up by administrative meddling. At Appomattox, Sheridan was perfectly free to act according to circumstances and had received the assurance of support in Grant's two words of reply.

16. PLANS HANDED IN AND GAME BEGINS.

The plan of campaign having been determined upon and the preliminary orders having been written out, the commander-in-chief on each side assigns his assistants, so that for each independent acting body there shall be if possible a player.

The sub-task leaders then make out *their* plans and, where necessary, *their* orders.

While one side has been thus employed, the other side has not been idle, and at last both have handed in their plans and orders to the umpire, and the second grand step in the game has been taken.

It is now time for the third and final step—the culmination, toward which everything has been working, and for which the previous steps have been but the preparation—namely, the test or trial. "The proof of the pudding is in the eating."

The umpire being thus in possession of both plans, looks them over, and announces the length of the first move.

Each player then plots his projected move on his own chart, makes a tracing on what is called a transfer sheet, and sends this in to the recorder, who transfers them all to the umpire's chart.

The umpire thus has before him the projected move of both sides. If no contacts develop, nor any information that would cause any player to modify his move, the second move will be an-

nounced, and the first move thereby stands confirmed. If, on the other hand, there be contact or information, it is transmitted by or through the umpire at the proper time to the affected party, and he is permitted to modify his move in accordance therewith, starting from the *game* time at which the word reached him.

The rules for values, contacts, etc., are all laid down in the book of rules, and it is unnecessary here to go into those details; therefore, we will pass on to the types of problems that will develop as the game proceeds.

17. THE SUB-SITUATIONS WHICH EMERGE.

The forces are beginning to move, and are liable to meet the enemy; scouts are being pushed forward to discover the adversary's whereabouts; protecting screens must be thrown out to guard the advancing battle squadrons from surprise; the train and convoys must be protected; or, on the other hand, those of the enemy may have to be attacked. We could proceed down in this way to the smallest detail, but in practice the smaller details are treated in small games, and the results form the basis for conventional rules or summary decisions of the umpire when they arise as incidents of the higher games.

18. PERMISSIBLE DISCRETION DEPENDENT ON ABILITY TO PERFORM SATISFACTORILY.

It is the ability of the subordinate satisfactorily to grapple and solve the problems that may be assigned him as sub-tasks which permits the commander to treat such sub-tasks as, so to speak, the ultimate units of his problem, just as a captain may direct a boat to be manned, or the ship to be ready to sail at a given hour, without burdening his mind further with the details, and feel himself free to deal with the greater question which induced him to cause the boat to be called away, or to desire to sail at the hour named.

In regard to this liberty of action, let us, before passing on, be quite sure that we understand clearly the relation that binds commander and subordinate. The underlying basis is *loyalty to the scheme;* and this of course demands that there be a scheme to be loyal to. While we are urging the commander to grant all possible liberty to his subordinates within the area of their discretion (don't forget the limitation), there is a very sharp distinction between liberty and license: liberty is not the right to do as you

please; it is the right to do *right* as you please; license is the right to do *wrong* as you please. Liberty, we thus see, has a very decided string to it. The radius of the possible area of liberty is directly proportionate to the subordinate's ability to do right, and the freedom which will be granted depends directly on the commander's confidence that the subordinate, left to himself, will deal correctly with the situation.

If in addition there be a common "doctrine" between the two, mutual confidence will result, and they will understand each other, as the French would say, with "half a word."

It is thus directly to the interest both of the commander and subordinates that the latter be trained to do right naturally, that the right be made the line of least resistance; and it is up to the commander to see that they get the opportunity.

A newspaper has lately printed an anecdote, the authenticity of which is not guaranteed; but "*se non è vero è ben trovato.*" It is to the effect that:

While a certain distinguished officer was instructor at West Point he gave the following problem:

The flagstaff at your station has fallen down. Your commanding officer directs you to get it up again. You have under your command a sergeant and twelve men of the Engineer Corps. How would you go about it?

Various schemes were submitted. All wrong, said the instructor. You simply order: "Sergeant, put up that flagstaff!"

The key to the solution lies in the words "of the Engineer Corps," which imply in the sergeant and his people the possession of the requisite ability.

19. RESULTS EVOLVED FROM THE GAME.

The principle of the concentration of the fleet, now generally accepted in our navy, was the direct result of a strategic game here at the College in the summer of 1903. Dissemination had been our rule for years, *i. e.*, the ships were divided more or less impartially among the stations "to show the flag" as the expression was; and at that time the same rule was general with other nations. At the beginning of the game most of the conference had never entertained a suspicion that the custom was not perfectly correct; but at the end there was but one voice, and that strong and outspoken for concentration. But this view, which required but the

time of one game thoroughly to capture the entire conference, took many a weary month before by mere argument it could convince all of those of our naval authorities who had not had the privilege or opportunity of "seeing with their eyes." It was some time after this that England adopted the same principle. A game played here about that time and sometimes referred to at the College as that of *"The Double vs. the Triple Alliance,"* (in which Russia and Japan figured among the contending powers). caused those who had taken part in it to have but little doubt, at the outbreak of the Russo-Japanese War, of the outcome of that conflict. It may not be unreasonable to believe that, had the Russian Naval General Staff played the Russo-Japanese situation out on chart and board, and had their officers had a little game experience on the same lines, their actual plans would have been very materially different

When the news came of the battle of August 10, and every one was wondering why at sunset, seemingly at the very crisis of the engagement, the Japanese battle squadron withdrew and apparently yielded the field, and all sorts of reasons were being advanced to account for it, we here at the College recognized at once an old friend, and laughingly exclaimed: "Hello! they have hit upon our retiring search curve!"

We can all recall that at sunset of the first day of Tsushima, Togo repeated the same maneuver, that is, drew off the battle squadron and headed for Matsushima, leaving the field to the torpedo boats. And no one can say that on that occasion, at least, it was because Togo felt himself beaten. No, what he did was, during the night to retire in the direction of natural escape of the enemy, so that at dawn he might find himself still outside of them. Then, extending his net, he could turn, and, as the fisherman's expression is, "scoup them in."

Even international law is affected and developed through the influence of this game. During one of the summer games referred to, played a year or two prior to the Russo-Japanese war, a division was driven into a neutral port, and the superior blockading enemy finding himself balked of his quarry made a demand on the neutral to intern the blockaded ships. Up to that time internment, as applied to the sea, had not been considered. It was taken up the next summer, as an international law situation; and, when the emergency arose in the war that followed, the result of the conference's

discussion was practically adopted by our government as the basis of its action.

I think I have shown, as much as can be shown in a short talk, the wonderful instrument that we possess in this game.

20. SECRET OF THE GAME'S POWER.

Now the great secret of its power lies in the existence of the enemy, a live, vigorous enemy in the next room waiting feverishly to take advantage of any of our mistakes, ever ready to puncture any visionary scheme, to haul us down to earth, and, above all, ready and anxious to "carry the war into Africa."

We know the tremendous interest that Greece took in its Olympic games, of the tremendous interest taken to-day in our yacht and boat races, rifle and tennis matches, ball games, billiard and chess tournaments, not only by those taking part, and those witnessing them, but by the public all over the country If we want to excite an interest in war on the chart, we must give opportunity to have it played, and opportunity for at least a reasonable number of people to become sufficiently expert to play games worthy of exciting interest. Fancy what it would be, if a yearly war game could be made to excite the same service interest as the West Point-Annapolis football match!

There were those who in the beginning railed contemptuously at the "ping-pong" or Morris tube; but should any of these have been met at the last battle practices, they would indignantly deny that they ever did such a thing; and such is the treachery of memory that there is no doubt they would believe it!

21. RELATION OF STRATEGY AND TACTICS.

Now, if in listening to what has preceded, we have taken notice of the direction of the lines of development, we must have perceived that the "decision" was the direct consequence of the "mission," that execution is simply the act to carry out the mission; no mission, no decision, and consequently, of course, no action, no fight. Therefore, a fight without a mission is action without purpose, muscle without brain. And this suggests what to some may seem a somewhat novel view of the difference between strategy and tactics—that is, the "inner" or fundamental distinction: Strategy, war from the point of view of the one who has an object to attain,

i. e., the planner; and tactics, war from the point of view of the executor; or something like the distinction between the architect and the builder, the playright and the actor.

While the distinction between strategy and tactics is clear, yet when it comes to laying down the line between the two, we find that they encroach somewhat upon each other's domain, each tending to overlap. This alone is sufficient to show that their movement of approach is from opposite sides. Strategy is the thought seeking its means of execution, and tactics is the means to carry out the desires of the thought.

It follows from what has been said that tactics is the servant of strategy, that every tactical problem should have a strategic setting, or at least keep in view the master idea which it is intended to subserve. That is the reason why tactics left to develop by itself is like servants without a master. They are practically on a vacation, and nothing very valuable may be expected from them under those conditions.

22. TWO WAYS TO APPROACH A SUBJECT.

Yes, there are two ways of approaching any subject: what may be called (1) By the small end; and (2) By the big end.

(1) The small end: the way of the subordinate, the man who obeys. He learns to be skilful within his limited discretion. His necessity, his *im*pelling as well as *com*pelling cause is the order of his superior.

No order; no cause.

(2) The big end: the way of the chief. His compelling cause is the necessity of the problem, the necessity of the situation.

No situation; no necessity.

23. EFFECT OF WANT OF COMPELLING CAUSE ILLUSTRATED IN OUR NAVY DEPARTMENT.

This finds curiously apt illustration in the history of our Navy Department:

In time of peace, the natural thought of the civilian is to a peace navy—there being no war to conduct, there is no compelling necessity for a war conductor, and, in the absence of a compelling necessity the Department was *organized without that element!*

There being no provision for war directing co-ordination, each bureau or specialist branch drifted toward independent sovereignty—like the states under the old Confederation which preceded the Constitution.

The Civil War came, and departmental chaos gave way to a scrub strategy board, which in turn gave way to an assistant secretaryship filled by an ex-naval officer—not, however, without wading through Pinaforean experiences before reaching some sort of possible system. It was this very thing which during the Civil War awakened the founder of this institution, Rear-Admiral Luce, to the necessity of a War College.

Well, the war over, came the time of cutting to a peace basis; and what more obvious for the first cut than the war directing secretaryship, now no longer "necessary!"

Next came a couple or so of still-born wars with the inevitable hurried, temporary expedients; and finally in 1898, the war with Spain. This time it is a strategy board.

After the war was declared, this board was hurriedly, as usual, organized and assembled in the same makeshift way. And here, too, following the same seemingly inexorable law: the war over, and our experience having shown the board to be very valuable, indeed in war indispensable, it was, as usual, promptly passed into the scrap heap.

24. THE SOLUTION.

WHAT THEN IS THE TROUBLE? *It is in the want of a compelling necessity.*

How then shall we supply this compelling necessity? As, in our history, war seems to have been the only thing that has had the requisite power to compel, and as we cannot have *actual* war in time of peace, why not have recourse to *artificial war?* It possesses the advantages without the disadvantages, has proved itself fully adequate to the purpose in the case of Germany and Japan; and here in our own case, notwithstanding the very limited opportunities we have had for its exercise, it has already exerted such an influence for good as to justify us in expecting much greater things when properly utilized.

25. CONCLUSION.

And now, gentlemen, in conclusion:

Success in any art may be regarded as the product of three factors:

a—the right thing,
b—rightly applied,
c—in time.

If either of these factors is zero, the result will be zero. The right thing rightly applied too late, the right thing misapplied, and the wrong thing, whether applied or not—neither of these combinations promises success.

When from a study of the experience of past wars, and of that of *artificial* wars checked up by suitable trials in the fleet, we shall have discovered what is the "RIGHT THING"; when, by the practice of artificial war, we shall have so familiarized ourselves with the various theaters of war, the situations and their appropriate solutions, that we can see "THE RIGHT THING," "RIGHTLY APPLIED"; and finally when, by persistent practice of artificial war, we shall have so trained our appropriate mental muscles (the mental processes), that the proper line of reasoning has become the *line of least resistance,* so that we shall think right even if we have no time to think at all—instinctively, actually quicker than thought—thus enabling us to do the "RIGHT THING," "RIGHTLY APPLIED," "IN TIME," then, and then only, shall we fully realize the true meaning of the saying that "the best school of war is war!"

Steam applied does work; steam unapplied is but hot air. In the words of Captain Jack Bunsby: "The bearings of this observation lays in the application on it."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE NAVAL WAR COLLEGE COURSE.[1]

By CAPTAIN W. L. RODGERS, U. S. Navy.

On September 30th the War College completed its twenty-seventh summer course and at the same time its first long course of sixteen months.

The attendance during the summer was larger than in previous years and the results were proportionately better, as the larger the attendance the better the work done. As the object of the courses is preparation for war, it is second in importance to no other duty, and the attendance cannot be too large. Those who have taken the courses realize their highly practical nature, and the advantages derived from them. As many officers as practicable should take the courses, and selection for them should be regarded as a compliment, as is the case in the army with the Army War College.

The long course began on June 1, 1911, and has thus lasted sixteen months. It was identical with the short or summer course of 1911 for the first four months; and a continuation of that summer course for another eight months until June 1, 1912, when the summer course began for a new class, and the long course officers took up, for their second summer, an advanced line of work distinct from that of the new comers.

The work of the War College is professional training, but it is of a kind entirely different from that given at the Naval Academy and its allied post-graduate courses.

Commanding officers, of whatever grade, have duties of two kinds. The first includes all the administrative duties relating to the care and maintenance of the command whose object is to develop efficiency and preserve safety.

[1] A report made to the Secretary of the Navy under date of October 18, 1912.

Studies relating to these administrative duties are pursued at the Naval Academy, and include the technical courses relating to ships and material and the management of the same, and also drills, etc., belonging to the management of the personnel.

The second kind of duty falling to commanding officers is that concerned with leadership. To this belong all those dealing with the military employment and utilization of the force which the commander has under his control. The studies referring to this kind of duties are pursued at the War College, and, unlike those of the first kind, their ultimate object is to promote the military efficiency of the individual rather than that of his command.

The subjects of study at the War College are national and military policies, strategy, tactics, and logistics.[2] But as the success of strategic and tactical movements rests on a foundation of sound organization and administration, it is necessary to include these latter subjects also in the courses.

Further, the War College course includes international law. This subject, as far as it relates to naval affairs, belongs naturally to the kind of studies here pursued as it is intimately connected with strategy and tactics. These latter arts are concerned with the commander's use of the forces at his disposal, while international law deals with the limitations placed on the commander's freedom of action in carrying out his strategic and tactical plans. Thus the whole group of subjects studied here are closely knit as bearing on the practice of war.

The international law situations brought before the conference here always deal with subjects of present interest upon which the law and practice have not yet fully developed a general rule of action.

The solutions are published each year by the Navy Department. They are distributed not only to the navy, but they are called for by public libraries and students of international law, and have a high reputation abroad. They have had a marked effect in modifying recent development of international law.

In conducting the course at the College the object has been twofold; 1st to study naval and military history and to place the principles of warfare on a sound basis, and 2nd, to acquaint the service

[2] A paper on this subject by the War College Staff will shortly appear in the PROCEEDINGS.

with these principles, and with their practical application to war, so that when war comes it will find prevailing among all the individual officers a common school of thought, and a common doctrine of practicing war which will ensure harmonious action and co-operation in all parts of a command.

This plan is carried out by what is known as the applicatory system, which is an employment of the principles of sub-caliber target practice in strategic and tactical situations. A series of situations are issued for study and solution by the individual members of the class.

So far as concerns the mental processes that are acquired in dealing with each situation, the conditions are those of war itself, and by handling many such situations the student becomes expert in dealing with them, so that the real war confronts him, only the physical shock of battle is unfamiliar to him.

These situations, in the way they are dealt with, form subjects for three different exercises, namely:

1. Formulation of orders.
2. {Tactical / Strategic} Problems.[3]
3. {Tactical / Strategic} Chart maneuvers.[4]

The *Formulation of Orders* is an exercise in administration, and deals with the proper organization of the command for the special task in hand, with the proper distribution of tasks to the subordinate leaders, with the supervision and proper degree of control to be exercised, and with the freedom to be permitted to subordinates.

The *Problem* deals with the initial phase of a situation, and is made a means of inculcating logical methods of considering tactical situations, and of making sure that important features are not overlooked. It is also a means of exercising and encouraging boldness and promptitude of decision in emergencies.

In the *Chart Maneuvers,* the two sides are pitted against each other and a situation, instead of remaining an isolated phase as in the problem, is developed into a series of successive and related phases reproducing a campaign or a battle in miniature. In ad-

[3] See PROCEEDINGS, No. 143, Sept. 1912, p. 1011.
[4] See PROCEEDINGS, No. 144, Dec. 1912, p. 1213.

dition, the individual members of the class are assigned the task of writing one or more theses on various tactical and strategic subjects, which are read to the assembled conference and discussed to the advantage of all present. Officers of the navy and civilians of distinction are also invited to read papers on subjects related to the War College work.

The result of such work is no longer doubtful. It is possible to note during the course that those taking it grow in readiness to accept responsibility, and in capacity to exercise high command; and in this our experience is the same as that of other nations. No officer expecting important command can afford to forego the course at the War College. Experience in command during peace offers no analogy to it, and all officers should be ordered to the College as opportunity offers.

I desire to point out, however, that the most desirable time for any individual to come here is when he is considerably younger than has hitherto been the general practice of the Department.

I think that between 30 and 35 years is the age at which it is most profitable to the individual and to the service for officers first to attend the War College.

Before thirty years, one lacks sufficient foundation of experience, while the longer one puts off attendance after passing thirty-five, the more difficult it is to grasp and accept the new line of thought and the professional training which is presented.

Moreover, a course at the College at a comparatively early age exercises a better and more continuous influence upon the service because the earlier one comes, the longer before his retirement he is practicing, and therefore teaching, what he has learned.

At present the War College can accommodate about 45 officers in addition to the staff of the College.

I recommend that the annual detail for the College be established at 15 for the short course, beginning June 1 and lasting to September 30, and 15 more for the long course beginning at the same time and lasting till September 30 of the subsequent year. This arrangement will fill the College each summer, as the remaining 15 will consist of those of the previous summer who are finishing their long course. Of the annual number detailed, I recommend that one-half be lieutenant-commanders and lieutenants within two years of promotion.

The work of the staff is arduous, as the work of the class must

be closely supervised and, besides, the staff must do original work in the preparation of situations, etc., investigation of principles, etc., which is independent of the size of the class. For this reason it is desirable to have the staff larger than at present; and, including the president, it should be increased to ten members. This would give an organization as follows:

1. President.
2. Secretary and keeper of confidential archives and general administration.
3. International law to work with professor of international law.
4. Military subjects—Marine officer.
5. Army War College detail to keep in touch with the army and army methods.
6. Historical studies in tactics and strategy for application in the chart maneuvers.

7. } Instruction in strategic problems and maneuvers.
8. }

9. } Instruction in tactics, problems and maneuvers.
10. }

As officers versed in these branches are not numerous in the navy, the chief source of supply is to obtain them from the class at the College by retaining those who show aptitude in this line after completing sixteen months of study, so that they break joints with their predecessors and ensure a continuity in the development of the course. It is desirable for this reason that the tour of duty of members of the staff should not be cut short, and I recommend that the detail of members of the staff be made for three years including the sixteen months of preparation in the long course.

The above recommendations concerning the augmentation of both the staff and the attendance at the Naval War College are based upon the undisputed fact that heretofore there has not been given to the instruction of officers in the art of war the attention that its importance clearly demands. The result is that an insignificant proportion of officers have taken advantage of the opportunity to obtain this instruction which the War College offers, and as a consequence there is no unity of opinion as to how war should be conducted, either strategically or tactically.

The Assistant Secretary of the Navy stated at the opening of the Summer Conference of this year:

I fear that at times the importance of the study of the art of war is lost sight of.

It is most desirable that the work of the War College be emphasized.

Only by a careful preparation on these lines (study of past wars, the experience of others, consideration of all possible contingencies, etc.) can an officer adequately supplement the technical and administrative training he obtains elsewhere. No line officer is fully qualified for command unless and until he has made such a study, and this War College was established and is maintained to afford suitable opportunity for such study.

Next to actual war, a well-planned War College course affords the best opportunity for such development thus far devised.

It is in view of these admitted facts, and of the manifest imperative necessity of establishing with the least practical delay a doctrine of war generally understood and accepted by the officers of the service, and of the fact that this can be accomplished only through the work of the War College in training officers, that I urge that the output of the College in trained officers should, at least in the immediate future, be as great as practicable.

Moreover, since, in the meantime, the instruction of the officers of the fleet in knowledge of the art of war must necessarily depend upon the knowledge of war possessed by its commanding officers, it would seem apparent that, in so far as practicable, all officers should, before being ordered to important commands, be required to take at least the short course at the College—this practice to be continued until the younger students (from 30 to 35 years) recommended above, reach the command grades.

In conclusion it is well to say that these recommendations are in accord with the policy advanced by my predecessor at the War College in his letter to the General Board of October 19, 1911.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MENTAL AND MORAL TRAINING FOR WAR.*

By SURGEON J. F. LEYS, U. S. Navy.

In a lecture† delivered before the War College Conference by Professor Hugo Munsterberg in June, 1912, the psychological conditions existing in war were described.

In the preparation of this paper an attempt is made to arrive, if possible, at some conculsions which may be of a practical character. Interesting as the subject of mass psychology is, it can have no value in this course if its interest is purely academic. The question for us is: In the preparation for war can anything be done in the way of mental and moral training which will, under the psychological conditions of war, contribute to our success in arms? Apparently some preparation of this sort is possible.

The preparation of the individual for war begins long before his enlistment in the armed forces of the country, or his attainment of adult age. Lieut.-Colonel Montaigne, of the French General Staff, says: "The preparation of a race for war is made by its mothers and its schoolmasters." And in another connection he states that war in its essence is not an art or a science, but a morality (*moralité*); that is, a moral system or idea. This is true or it is not true. War is right or it is wrong. It is necessary or it is unnecessary. Under our free institutions every individual, educated or uneducated, will not only have his opinion but will freely express it. But that war is necessary and right is the opinion based upon history. The contrary opinion is at variance with the dominant fact in all history, that the racial progress and national development of mankind have been accom-

* Lecture delivered at the Summer Conference, U. S. Naval War College, Newport, R. I., September 18, 1912.

† In Archives, Naval War College.

plished with the waging of war, and by it. A theory that the same progress might have been accomplished without war is untenable because it is nothing but a theory, based on no fact. With this moral philosophy of war the biological law of evolution is entirely in accord. "It is the destiny of the weaker to serve as food for the stronger, the purpose which the weaker exists to fulfill. The stronger develops its strength in conquering the weaker and this is *its* destiny. Might is right" (Montaigne). This is not a mere political theory. It is a biological fact.

It behooves us then, in our national preparation for war, to look to our schools. Are our children receiving in the majority of our schools, public and private, the sound teaching supported by history and biology that war is inevitable, necessary, right, a moral idea? Field Marshal Count Moltke says:

> Selfish and worldly activity, looking only toward the gratification of all desires of the individual, undermines the foundations of higher moral philosophy and the belief in ideals. Fools arrive at the vain conclusion that the life object of the individual is acquisition and enjoyment; that the purpose of the state is simply to facilitate the business affairs of its citizens; that man is appointed by an all-wise Providence to buy cheaply and sell at a profit; they conclude that war, which interferes with these activities, is the greatest evil.

It is to be feared that too many of our children are receiving either such false teaching or no teaching at all. Too many of our boys attend schools where virile influences are lacking. Co-education of the sexes is carried too far up in age. Boys should not be taught to so large an extent by spinsters. Boys should go to school to men and girls to women. The revival of the schoolmaster as an honorable, honored, and well-paid position for the highly and soundly educated man is a national need, of direct importance to the future security and defence of the nation.

The pulpit and the newspaper are the schoolmasters of the great mass of our adult citizenship. It cannot be said that either of these influences tends, upon the whole, to inculcate a sound morality with regard to war.

Under the freedom of this government, any private individual, or association, society, or sect has the right, at its own expense, to maintain schools in which its own sons may be brought into a feministic atmosphere and taught an individualistic philosophy, and to employ teachers as incompetent as it pleases. But it is still true that the very large majority of the present active gener-

ation of our tax paying and voting citizens are as level headed and right thinking as the citizenship of any other country. The whole public which supports the public schools has a right to demand, and if its active interest in this particular matter could be aroused I believe that it would demand, that public funds should not be expended in public schools for the employment of persons who, through insufficient education, or personal bias, are incapable of giving instruction which squares with the teachings of history and the facts of daily life. Sound teaching in the individual's relation to the state and in his duty to support and defend it should be required, the unsound teachings of mere individualism should be prohibited; and the teacher unable or unwilling to teach in a state school in accordance with principles approved by the state should be considered incompetent and disqualified.

The Navy League might properly concern itself with this aspect of public education, and it might well bring such wholesome influence to bear as it can upon other departments of the Federal Government in this connection. Its attention is invited to a recent publication by the Bureau of Education, at Washington, in its Bulletin No. 8 of 1912.

No one will gainsay now that mental equipment and training for the operations of war is at least quite as important as material preparation. That is the very meaning of the existence of this War College.

Napoleon stated that "in war the moral is to the physical as 3 to 1." A similar opinion seems to have been held by the highest authorities on the subject of war in all times and countries. Anyone who would venture to hold a different opinion should be able to give reasons.

Colonel Montaigne says: "Force is not the number of the personnel, nor the sum of the material, it is 'la vertu.'" Virtue is here used not in a narrow sense but in the broad sense of the Latin *virtus*, manly excellence. So, too, the word *morale*, Latin *mores*, meaning both manners and morals, is used in the broad sense of the Wykhamites whose motto is "Manners makyth Man."

Clausewitz says: "To what would a theory of war degenerate which left the moral qualities out of consideration?—to a mere military arithmetic or a military geometry—that is to say, to a nonsense." Guibert says: "Every battle is a moral battle."

The subject of mental and moral training for war seems to fall naturally into the following divisions:

(1) The training of the individual, whether officer or man, largely a self-training.

(2) The training of the officer as such.

(3) Training and control by officers of the body of men under their command.

(1) Colonel Montaigne says: "The preparation of the soldier for war is to make him hardened against fatigue, insensible to suffering, ready for death. He should enter battle with no mercy for himself and none for his enemy. To eliminate fear he must train himself to despise his own destruction and to be ready to sacrifice himself."

This author (Montaigne) devotes the first 101 royal octavo pages of his book to the subject of fear and a considerable number more to means of overcoming it. He says that a leader may well be more concerned with the dread of fear than with the dread of danger. His conclusion is that the cure for fear and its effects upon the rank and file is in the awe of authority. The remedy for "la peur" in troops is "la crainte," impressed by the severest discipline. Whatever the *applicability* of this idea in other races and under other governments, it is not applied, not practiced, probably not available as a means of controlling or eliminating fear in American troops or naval forces. And it does not seem to me the logical answer to the problem of eliminating fear, and more definitely the fear of death. It is a purely artificial method to employ, and it appears likely in most cases to fail.

Nine-tenths of all fear is the dread of the unknown. Nine-tenths of all fear is eliminated when the unknown becomes known. Suddenly placed in an unaccustomed environment with unknown forces in play around him, the possible effects of which at any moment may be injurious or painful, the individual is possessed by fear. Persons of nervous temperament are more accessible to this influence of the unknown or unaccustomed than those of phlegmatic temperament, but none are quite free from this fear of the unknown. The liability to fear of the unknown and the reflex effects of fear are physical conditions, largely beyond direct control by the higher consciousness. Illustrations could be multiplied indefinitely: The fear of the dark and unfamiliar road, which disappears as it becomes an accustomed walk, the fainting of the

strong man at the sight of his own blood shed in the smallest quantity and even painlessly by the surgeon's lancet, though the same man will undergo the most painful ministrations of the dentist with the nature and extent of whose work he is more familiar, the ducking of a soldier or sailor as a shell hurtles overhead in his first battle, though he sees the absurdity of such a movement with further experience and better knowledge. Fear is removed by familiarity, by knowing the facts. A knowledge of the actual facts concerning death should serve to remove all dread of death as a personally painful experience, for it is not so. The termination of the life processes as a consequence of disease or injury is not a painful phenomenon. It has suited poets, romancers, and to some extent religious preachers so to misrepresent it. To the extent that they have done this it has been part of their stock-in-trade. But this is pure fiction. It is not the stuff with which to feed up the mind that we would make sound and strong. The fact is quite the contrary of this. I have seen a very considerable number of men dying, perhaps as many as two hundred, and I have never seen a dying man afraid to die, nor a final dissolution that was painful. I have compared notes on this subject with many physicians and have always found their experience the same. The fear of death in itself is a fear of the unknown, fed upon false teachings and not justified by any fact. The attitude of the sound and well-regulated mind should be that death may be undesirable and inconvenient for business reasons of a personal or domestic nature, that is all. The naval or military man should make his property secure, take out necessary insurance, make his will, and as far as possible remove anxiety for those dependent on him as a factor tending to disturb his equanimity in approaching hazardous duty. Death will not hurt him personally, at the time, nor will he experience any subsequent ill-effects from the occurrence.

The mentality of man has a physical basis. Mental processes are a function of certain cells. There is no function, secretion, motor discharge, or efferent impulse of any kind from a cell except in obedience to the stimulus of an afferent impulse of some kind reaching that cell. All activity is reflex, none is spontaneous, as non-biologists are too apt to suppose. That *many* actions are reflex is taught in the elementary schools and is well known to the laity, but it is not so well known that *all* vital action

in living animals is so. The reason this is so is a fundamental one. It rests upon the cell-doctrine of life. Man is but a community of highly specialized individual cells. The cells of his brain and nervous system are cells in which the fundamental vital property of irritability, common to all cells, has been highly specialized. The activity of the mind, like every other vital process is a cell-function. A man cannot do anything his cells cannot do, for he is nothing but a mass of specialized cells. Mental health and strength have the same kind of physical basis as powers of a grosser sort.

If you approach the problem of developing and maintaining your individual efficiency with these fundamental facts clear to you, the relation of a cell-poison such as alcohol to your efficiency will be clearer than any moralist who confines his arguments to the abstract can make it. Von Moltke said "Beer is a more dangerous enemy to Germany than all the armies of France."

The higher centers, the centers of conscious mind, take cognizance of many actions, choosing and controlling the motor discharge with which response is made to the afferent stimulus received. But when the same afferent impulse leads many times to the same motor discharge, habit is established, the higher centers cease to exercise attention to the action, and to choose, direct or modify the motor discharge. Such habitual reflexes are said to be carried out by the *subconscious mind* without the cognizance and control of the *conscious mind*. This talk of conscious mind and subconscious mind is a mere *façon de parler*, the jargon of psychology, a convenient formula used because it serves well for purposes of discussion, just as the atomic theory serves in chemistry.

Conscious mind (*i. e.*, the higher centers) may be off the job by reason of complete suspension as in sleep, in the hypnotized state, or in some forms of mental disease. Or it may be off the job because it is being constantly diverted by new impressions, or so disturbed and depressed by fear as to be incapable of functioning in the government of action.

It is here that the value of habit in the individual appears. Under these circumstances, with his higher consciousness benumbed and his judgment suspended, the undisciplined individual will, on the receipt of an afferent impulse, either do nothing, or he will do a wrong thing. But if discipline has established in

him a habit; if his lower centers, on the receipt of an auditory afferent impulse, the bugle call or the word of command, are habituated to giving the appropriate motor discharge, he advances, takes his station, or fires, though his higher mental functions may be in a condition of suspension, or of distraction.

(2) We have now to consider the psychology of the individual officer who is to control the mass of personnel and material, and upon whose individual capacity and staunchness the issue of battle depends. It is upon his moral force, his *morale* in the broadest sense, his virtue (*virtus*) that the issue rests.

Few men are essential or incurable cowards. Brute courage, so-called, freedom from any serious fear of pain or death, is a fairly common commodity, and fairly cheap. You can get it in the market in quantities as required, for about $15.00 a month, and of a quality which will probably not fail you in the hour of need.

Most men, unrestrained by law, will fight, even against odds, for what they want. With moral courage, developed by discipline, they will fight for the rights of others, and sacrifice themselves. But this courage, and the higher manifestations of courage which make up the man's total moral efficiency, or *morale*; and all of a man's moral and mental activities no less than his so-called physical activities have a physical basis.

The activities of his brain are arrested or vitiated by disease as promptly as the activities of his muscles.

The importance of staunchness, self-control and readiness for self-sacrifice, and of good habits in general, is sufficiently emphasized by all authorities on military responsibility and conduct. As to the idea of a special *genius for war*, Clausewitz disposes of this with the opinion that the phrase has no special meaning, that in connection with war the word *genius* is to be taken only in its ordinary sense, "a very high mental capacity for certain employments."

Lieut.-Colonel Foch, of the French General Staff, states that the first trait to be developed in the mental training of the officer is *subordination* and the second *initiative*, no less necessary than the first—that initiative defined by von der Goltz as "The manifestation of the will power of the individual, backed with sound judgment and acting in accordance with the plans of superior authority."

The importance of the study of the art of war needs no emphasis here. Every officer who has had the advantage of the War College Course in recent years appreciates, at its full value, the fact that the mental processes exercised and made familiar and habitual by the strategic game, and those which would be required in the strategy of actual war are identical. The mental training involved in this course is therefore of the highest practical value to the officer who will be charged with responsibility in the prosecution of war. The factors which must be considered in war will range themselves in proper sequence in the mind habituated so to deal with them.

Concerning the effect of the events of war upon the mind (the higher centers), Clausewitz says:

> In war owing to the many and powerful impressions to which the mind is exposed, and, in the uncertainty of all knowledge and of all science, more things occur to distract a man from the road he has entered upon, to make him doubt himself and others, than in any other human activity. . . .
>
> . . . Often nothing else will help us but an imperative maxim which, independent of reflection, at once controls it: that maxim is, in all doubtful cases to adhere to the first opinion, and not to give it up until a clear conviction forces us to do so. We must firmly believe in the superior authority of well tried maxims, and under the dazzling influence of *momentary events* not forget that *their* value is of an inferior stamp.

The necessity of bearing in mind and acting upon this principle has been illustrated in at least one of the problems played out here this summer.

In concluding this part of the subject which has to do with the mental training of the officer, a difference may be pointed out between the conditions surrounding the commander-in-chief of land forces and those in which the commander-in-chief of naval forces must often exercise his highest faculties to arrive at reasoned decision. Clausewitz says:

> So far as the enemy's activity affects the general directly in the matter of danger to his person, this is a factor which plainly diminishes the higher the rank of the commander. To what does this factor amount for one in the post of commander-in-chief? It is nothing.

It is plain that the disturbing factor of immediate personal danger will very often be brought to bear upon the naval commander-in-chief in action; though his most important mental labors will have been discharged, under modern conditions, before battle is joined.

(3) We now come to the third and last subdivision of our subject, the training and control by officers of the body of men under their command. And here, again, naval conditions are in important respects different from those obtaining with land forces. There is little danger of panic in the crew of a modern ship on the way into action. The men below who propel the ship as ordered are not exposed to those impressions which startle the senses, strike with fear, and make for panic in land forces advancing into battle. The commanding authority directs the course. Explosive sounds overhead and about the ship have been made familiar by target practice and have long ceased to be in themselves disturbing. The evolutions of battle practice reproduce with almost perfect similarity the conditions of actual battle. The habit of fixed attention on his proper duties is well developed in each individual, and the strain and fatigue are much the same. The individual who might be seized with panic has no chance to bolt to the rear and be followed by others.

Remember the points of mass psychology, explained more in detail by every writer on this subject. The psychological characteristics of the crowd, whether a theater audience, a mob, a regiment, or a ship's crew, or any other close collection of men brought together by some common interest are:

First, a suspension of the sense of individual responsibility.

Second, an increased susceptibility to suggestion.

Translated into physiological terms, this means that the receipt by the lower centers of the necessary afferent impulse will give rise to an efferent discharge (action) without review and check by the higher centers—which would regulate the action according to reason but for the fact that, in the psychology of the mass, they, the higher centers, are in suspension, prevented from functioning.

In dealing with the mass of men under orders, we have to take every precaution that selection and training can give, that they shall not receive and act upon a wrong suggestion at the critical time. Such a suggestion might be received from gruesome sights to which they are not accustomed.

The physical reflex action (in the direction of panic) which may be produced by the sight of bloodshed, or of mangled bodies, is not a reasoned action controlled by the higher centers. It is not caused by a reasoned feeling of danger to his own person, a

fear that similar injury may at any moment overtake himself. It is entirely independent of this. It is not an intellectual fear but a purely unreasoning, involuntary, physical reflex, produced by the unfamiliar. It is what I have already called *the fear of the unknown.* Precisely the same physical reflex is seen in many medical students at their first surgical clinic, where it is evidently not caused by the presence of any danger to their own persons. Nor is it the effect of sympathy with the sufferings of others. The same physical reflex will be produced in nine out of ten normally strong men who are taken into a dissecting room at night for the first time. The intellect will ridicule and repudiate such a condition, before, during and after the visit, for it has no intellectual basis or justification, but it is there, a physiological reflex, a definite, tangible, physical condition.

These facts indicate that our solution of this end of the psychological problem, how to deal with the mass to be led, lies along these lines.

First. Eliminate as far as possible the fear of the unknown. This is largely accomplished by making familiar, as far as possible, the physical environment of war, which if unfamiliar would tend to astonish and startle the nervous system. Fleet evolutions tend to fortify the mind, unconsciously to itself, against the fear of collision or ramming, or of undetected approach for torpedo attack. Target practice gives familiarity with noise, recoil, the hurtling sound of the shell in the air, all of which would disturb the senses if unfamiliar.

The idea emphasized by the surgeon-general in his address here a year ago, that each battery group in the ship should be made as self-sustaining as possible in the matter of first aid to its own members, both as regards material supplied and skill in its use; and that the medical force of the ship should, as far as possible, go about during the battle and relieve visible suffering, and relieve the men at work from the disturbing effect of gruesome sights; this principle probably has a high psychological importance for efficiency in battle.

Secondly. With a ship's company so well familiarized with fleet exercises and target practice as our men are, it is probable that the first phenomenon noted as characteristic of mass or mob psychology would not, in a naval action, come to the fore to be reckoned with, namely, a suspension of the sense of individual re-

sponsibility. But the other important psychological mass effect would probably be present, namely, *increased susceptibility to suggestion.*

It would be well to accept this as a basis for action, and the action indicated might well have a practical value, especially for the personnel of all those units not in the first line, who would be kept for a time in the suspense of waiting. To make advantageous use of this psychological condition it is necessary to remember what has been proved by laboratory experiments. In normal suggestibility—whether of the individual or of the mass—suggestion may be successfully made by repetition, by frequency, by last impression.

(1) By *repetition* we mean technically the repeating of the suggestion again and again without other impressions intervening.

(2) By *frequency* we mean repetitions at intervals and separated by other impressions. *Frequency* is three times as powerful for effect as *repetition.*

(3) *Last impression.* Of several impressions the last is most likely to be acted upon. Last impression is five times as powerful for effect as *repetition* and nearly twice as powerful as *frequency.*

The strongest suggestion is obtained by a combination of *frequency* and *last impression.*

The application of these principles would be as follows: In a destroyer standing by for her opportunity to make torpedo attack, the officers repeat from time to time, "We'll have them just where we want them bye and bye." This and similar suggestions are frequently made. When the time has come to advance to the attack the order for speed and helm is accompanied with the suggestion, "Now we've got them." Under such conditions each man will be inspired by the suggested confidence in the result.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

LIFE INSURANCE.

By COMMANDER L. M. NULTON, U. S. Navy.

About the time of the cruise of the battleship fleet around the world, the writer, desiring to take out additional life insurance, was confronted with a flood of contracts in which the diversity of the options offered, and the wide range of the *cost per $1000 of insurance*, were bewildering. This led to a study of the insurance question in order to try to intelligently answer for himself the question "What am I really buying, what have I bought in the past, and why is it that the cost per $1000 of insurance is so much greater in some cases than others?" It is believed that the results, if simply stated, might interest the service.

If the average man were to deliberately go into a market and pay his money for an article of his own selection, and then be charged with buying something, and yet be in ignorance of what he had purchased, he would indignantly deny it.

That the above statement as to the ignorance of the purchaser of his purchase is really true in the case of the majority of those purchasing life insurance, is confirmed by writers on life insurance, by agents, and by a casual conversation with almost any policyholder, during which conversation one attempts to have him explain what his policy really grants him and how much this grant actually costs.

Many policies offered to the public are not *life insurance* policies pure and simple. They consist of life insurance combined with all sorts of financial arrangements, so-called investments, annuities, etc., to a degree that is bewildering; but the important point for a would-be policyholder to consider is the fact that, for a given set of insurance conditions, such as age, period cov-

ered by insurance, amount of insurance, etc., the *life insurance cost* is practically the same in every company; and, *in many cases, is only a small fraction of the amount paid in premiums.* It can be further shown that that portion of the contract that represents investment features is very expensive to the policyholder. Especially is this so in the case of salaried men without business opportunities, as, for example, naval officers.

It is not the intention, or desire, of this article to belittle, or attack, life insurance. Real life insurance protection is most desirable, has a definite place in the economics of our present life, and, properly taken out, is a boon to the man of limited means, in his efforts to protect his family. Life insurance in its real sense is *protection* and *not investment.* A writer on life insurance subjects says: "life insurance is and can be nothing except an agreement to pay a determinable sum on death.

"A pure endowment is no more life insurance than is an annuity, or a policy against loss by fire. It is in the varied departures from this essential definition that policies in scores of forms have been issued and called life insurance policies, *while the real life insurance was only part of the contract and usually not the most costly or remunerative part.*

"Life insurance is not an investment. It cannot possibly be. It is a protection, and like fire insurance protection, or any other form of insurance protection, it must be paid for. Its cost is the difference between what the premiums put in a savings bank at compound interest would amount to and what the policyholders receive. That difference in certain forms of insurance, even in the best and most honestly managed companies, has been over 10 per cent, and, in some cases, 25 to 30 per cent."

The principal instruments of all companies in determining the cost of insurance to policyholders consist of (1) mortality tables, and (2) interest tables.

The mortality table assumes that 100,000 persons, aged 10 years, start life together, and tabulates each year thereafter the number of those who die during the coming year, and those of the original 100,000 who are alive at the end of the year.

This table is based on the law of averages, and is the result of the analysis of a mass of statistics collected over wide areas and during long terms of years.

THE AMERICAN EXPERIENCE TABLE OF MORTALITY.

Completed age	Number surviving at each age	Deaths in each year	Completed age	Number surviving at each age	Deaths in each year	Completed age	Number surviving at each age	Deaths in each year
10	100,000	749	40	78,106	765	70	38,569	2,391
11	99,251	746	41	77,341	774	71	36,178	2,448
12	98,505	743	42	76,567	785	72	33,730	2,487
13	97,762	740	43	75,782	797	73	31,243	2,505
14	97,022	737	44	74,985	812	74	28,738	2,501
15	96,285	735	45	74,173	828	75	26,237	2,476
16	95,550	732	46	73,345	848	76	23,761	2,431
17	94,818	729	47	72,497	870	77	21,330	2,369
18	94,089	727	48	71,627	896	78	18,961	2,291
19	93,362	725	49	70,731	927	79	16,670	2,196
20	92,637	723	50	69,804	962	80	14,474	2,091
21	91,914	722	51	68,842	1,001	81	12,383	1,964
22	91,192	721	52	67,841	1,044	82	10,419	1,816
23	90,471	720	53	66,797	1,091	83	8,603	1,648
24	89,751	719	54	65,706	1,143	84	6,955	1,470
25	89,032	718	55	64,563	1,199	85	5,485	1,292
26	88,314	718	56	63,364	1,260	86	4,193	1,114
27	87,596	718	57	62,104	1,325	87	3,079	933
28	86,878	718	58	60,779	1,394	88	2,146	744
29	86,160	719	59	59,385	1,486	89	1,402	555
30	85,441	720	60	57,917	1,546	90	847	385
31	84,721	721	61	56,371	1,628	91	462	246
32	84,000	723	62	54,743	1,713	92	216	137
33	83,277	726	63	53,030	1,800	93	79	58
34	82,551	729	64	51,230	1,889	94	21	18
35	81,822	732	65	49,341	1,980	95	3	3
36	81,090	737	66	47,361	2,070	..	.....	....
37	80,353	742	67	45,291	2,158	..	.....	....
38	79,611	749	68	43,133	2,243	..	.....	....
39	78,862	756	69	40,890	2,321	..	.....	....

The above table starts with 100,000 persons who have attained the age of ten. Of these, 749 will die during the following year; that is to say, before they attain the age of eleven. Those, therefore, who attain the age of eleven will number 99,251, and of these 746 will die before reaching the age of twelve. Only three of the 100,000 will be alive at the age of ninety-five, and presumably these 3 will die during the year; that is to say, before reaching age ninety-six.

The interest table is important because practically all companies base their final charges to the policy purchaser on the assumption,

among other things, that money will earn 3½ per cent compound interest while in the companies' hands for investment. Interest is a factor in every calculation made by a life insurance company.

Before going further, there are two fundamental facts which must be established for a clearer understanding of what follows. These are:

(1) That all life insurance costs something to grant.

(2) That it costs more to grant insurance to an older man than to a young man. In illustration of the first statement, let us assume that all of those 100,000 people, given in the American mortality table, who have lived to reach the age of 35 desire to insure one another for one year for $1000 each.

From the table there are, at age 35, 81,822 people, of whom 732 will die before the end of the year.

Then:

Amount of insurance to be paid $= 732 \times 1000 = \$732{,}000$.

Number of people to pay it (in advance) 81,822.

Cost per $1000 per individual $\frac{732{,}000}{81{,}822} = \$8.94$.

It is thus seen that of the 81,822 people alive to start with, there are still alive at the end of the year 81,090, but as no one of the original 81,822 persons knew whether or not he would be one of the 732 to die during the year, each would have to pay $8.94 premium to insure his heirs receiving $1000 in the event of his death.

The above simple and self-evident fact is given for one purpose only, to emphasize the fact that it costs "a definite sum of money" to carry insurance, even though one may live through an insurance period.

In illustration of the second fact, that it costs more to insure an older man than a younger man, assume that the 100,000 people starting in the American mortality table had not thought of insurance until they were 71 years of age.

The process of determining the premium, under conditions similar to the foregoing, would be as follows:

Number of survivors at age of 71	36,178
Number of deaths during ensuing year	2,448
Amount of insurance to be paid $= 2448 \times 1000 =$	$2,448,000
Number of people to pay it in advance	36,178

Therefore, cost per $1000 for each person insured =

$$\frac{2,448,000}{36,178} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \$65.69$$

From the foregoing, it is seen that the cost per individual for $1000 insurance for 1 year, as calculated by this method, is $8.94 at the age of 35 years; and $65.69 at the age of 71 years.

It is to be noted in the foregoing calculations that the premiums calculated are all used in payments to the beneficiaries, and that no money has been used in the ordinary expenses, such as salaries, rent, postage, etc., of the business.

A premium so determined is called a *net premium*, the term signifying only that amount of money which it is necessary to collect from each of the insured to meet the mortality payments alone.

If we were to continue the calculation of net premiums by the method already described, starting with the age of 21, on the assumption: (a) that we would grant insurance only for one year at a time, and (b) would collect only enough money from each one to pay $1000 to the heirs of each person deceased during the coming year, our premiums would be calculated on what is called the *natural system*, and their values at certain ages, would be as tabulated below:

Age.....	21	31	41	51	61	71	81	91
Net natural premium.	$7.62	$8.26	$9.71	$14.11	$28.03	$65.69	$153.99	$516.96

An inspection of the foregoing table shows that the net natural premium is very small at first, but increases rapidly from year to year and is excessive in the later years of life.

As few men desire to carry an increasing burden, the natural premium is very seldom employed and its disadvantages may be met in two ways: (a) by paying in one lump a *single premium*, which, with interest, is the mathematical equivalent of all the natural premiums, or (b) by determining a fixed amount which, if paid each year, will be the equivalent of the natural premium, or of the single premiums. This fixed annual equivalent of the natural premium is called the *level annual premium*, and is used to-day in practically all policies, and by all companies.

The single premium is seldom used, as it is equally inconvenient to the insured because of the large amount involved in one payment.

The comparison between a natural premium and a level premium is illustrated in the following diagram.

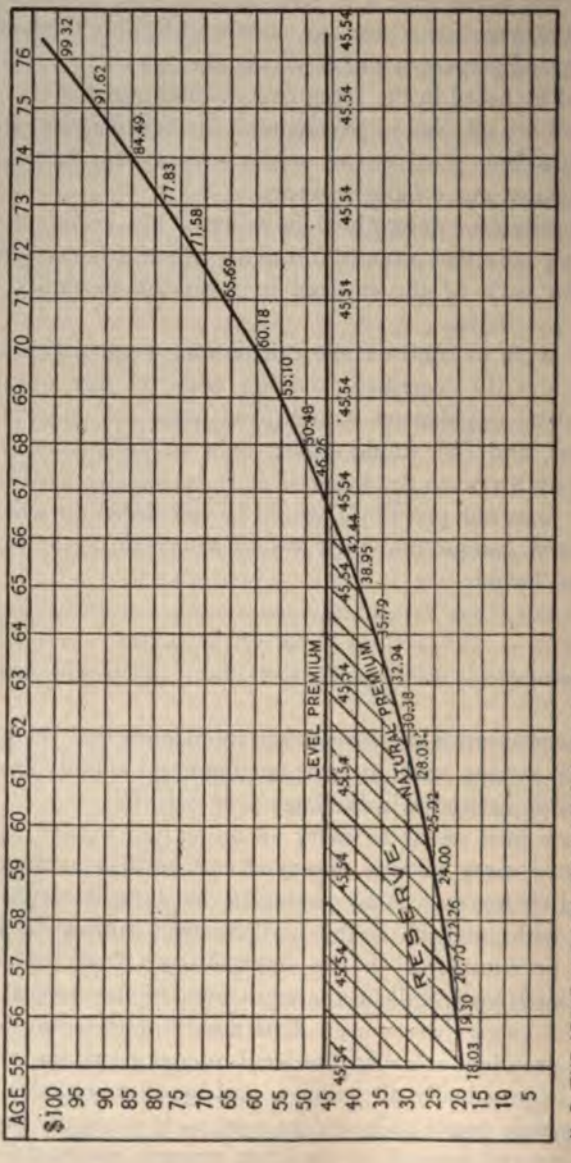

FIG. 1.

In this instance a man fifty-five years of age, having taken out two policies for $1000 each, would pay the first year, on his natural premium policy, the sum of $18.03, which premium would increase yearly to $99.32 at the age of 76.

On his other policy the level annual premium would remain fixed year after year at $45.54.

Loading.—All the premiums referred to so far have been *net premiums, i. e.,* those based on mortality payments alone.

To meet the cost of administering business, such as salaries, rents, postage, advertising, etc., a certain percentage of the net premium is added to that premium. This addition is called the *loading.* In participating policies the loading varies from 27 per cent to 33 per cent of the net premium; in non-participating policies the loading is about 8 per cent of the net premium.

Reserve.—By referring to the diagram above it will be seen that the net natural premium there given at age 55 is $18.03, and the net level premium is $45.54. The sum of the successive differences between these two quantities is the *reserve.* It is the amount paid in in early years in excess of the natural premium and is used to counter-balance the difference of later years when the level premium falls below the natural premium; or to automatically extend the policy should the payments of premiums cease. This requirement of a reserve is necessary in all level premium policies.

Gross Premium.—The gross premium is the sum of the net premium, the loading, and the reserve. It is also known as the office premium; it is the total amount per $1000 of insurance charged by the company before it will issue a policy.

From the foregoing it is seen that the basis of the method of paying the premium is as follows:

(1) The natural premium paid from year to year at an increasing rate, which rate increases in proportion to the probability of approaching death.

(2) The single premium, which is one single payment in a lump sum, this sum being the equivalent of the premiums in paragraph (1), and

(3) By the level annual premium, which is a fixed sum paid each year, the amount of the last payment being the same as the first.

(4) A modification of (3) in which, if it is desired, the policy

may become paid up completely in ten, fifteen or twenty annual payments. This is called a ten, fifteen, or twenty payment policy, and simply amounts to taking the premiums indicated in paragraph 3, above, and paying them all inside of ten, fifteen, or twenty years instead of stringing them out through life.

The question of interest is considered in each determination of a premium.

The level annual premium for a ten payment policy is naturally larger than that for a fifteen payment, and this in turn is larger than that for a twenty payment policy, which again in its turn is larger than a level annual payment continued throughout the average life. Each, however, with interest considered, is equivalent of the other and varies simply from the fact that, if we have a given sum to pay, the fewer the number of payments we make the larger they must be.

The principles involved in the foregoing methods may be crudely illustrated by Fig. 2.

Beginning at D with the age of an applicant for insurance, let each succeeding year of his expectation of life be marked off on the scale DC, and at each year erect an ordinate, which ordinate represents the cost, or premium, of the insurance for one year as calculated on the *natural* system previously explained. A line joining the ends of these premium ordinates will give a curve of natural premiums.

The area $ABCD$ between this curve and the axis will approximately represent the total amount to be paid in natural premiums. The level annual premium will then approximate the average ordinate, A_1D, such that the area A_1B_1CD = area $ABCD$.

If it is desired to pay up the policy in twenty payments instead of continuing them through life, make $DC_2 = 20$ years and find an ordinate (A_2D) such that the area $A_2B_2C_2D$ = area A_1B_1CD = $ABCD$. Then A_2D will represent approximately the value of the annual premium required to pay up the policy in twenty payments.

A similar process for ten payments will give A_3D as the annual premium; the area $A_3B_3C_3D$ being approximately equal to area $A_2B_2C_2D = A_1B_1CD = ABCD$.

The shaded area represents the reserve, which is that excess of payments in the early years of a policy which together with future premiums and interest will make up the deficiency when the level annual rate falls below the natural premiums; or which

may be used to extend the policy in case payment of premiums is stopped.

The foregoing illustration is not scientifically accurate, but crudely represents certain principles involved in the question of premiums and extended insurance.

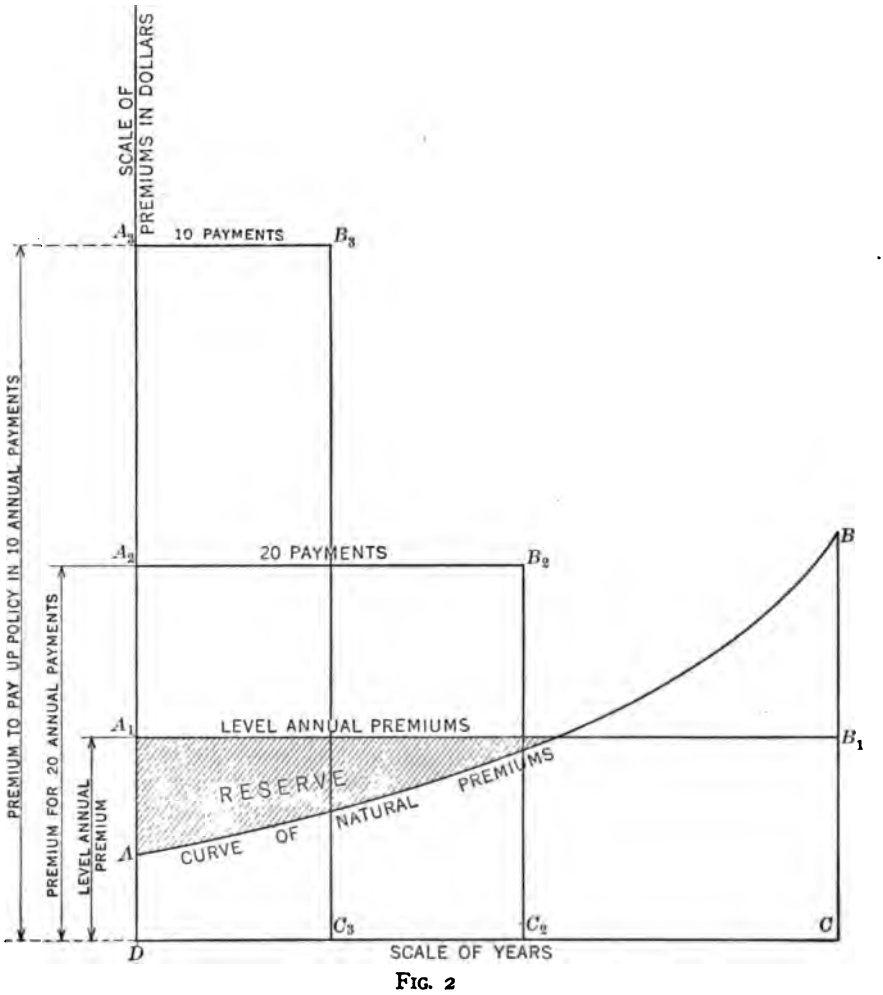

FIG. 2

Dividends, Surplus.—Every life insurance company, in order to be sure that its business balance for the year is a gain instead of a loss, must, among other things, make sure that the premiums

charged for its policies are adequate. To do this the gross premiums charged are in excess of the real needs of the situation.

In addition, while the net premiums charged are based on the average loss as determined by a mortality table, the company reduces this by not insuring at random, but by selection after medical examination. Again, the cost of running the business may not be as great as estimated, in which case the loading charged in the premium is in excess of the needs and produces a surplus. Furthermore the company's calculations are based on the assumption that funds in its hands for investment will earn 3½ per cent, when as a matter of fact they usually earn over 4 per cent.

The foregoing indicate sources which form a surplus, and this surplus is used for two purposes, as follows: (1) To protect the company against losses in its investments, or disturbances in the financial world, and (2) a fund from which to return to policyholders, as dividends, the excess premium charges they have paid in.

However, dividends are not always paid to policyholders. In a stock company pure and simple, the policyholder is a customer and the profits go to the stockholder.

In a mutual company a policyholder is a sort of partner and shares in the dividends.

In a company formed on the mixed plan, *i. e.*, combination of the stock and mutual plans, a policyholder may or may not participate in the dividends.

Dividends are of two kinds, annual and deferred.* An annual dividend policy calls for the return each year to the policy of whatever portion of the surplus the company sees fit to distribute.

* Most companies have now discontinued deferred dividend policies, some voluntarily, others by force of law. On January 1, 1907, laws passed by the legislature of the state of New York forbade the issue of deferred dividend policies by any company doing business in that state.

There are, however, deferred dividend policies issued under special names as follows: Accumulated surplus, accumulation policy, accummulated dividend, accumulation bond, allotment policy, distribution policy, dividend endowment, dividend tontine bond, guaranteed income, guaranteed option insurance and investment, investment bond, investment policy, life option, mutual investment contract, survivorship dividend.

For a list of the companies issuing these policies see the Unique Manual, 1912, published by Sampson Dawe, 501 Shawmut Ave., Boston, Mass.

Deferred dividend policies taken out before 1907 are subject to the remarks of this article.

Deferred dividend policies postpone the declaration of the divisible surplus and its distribution to some distant period, 10, 15, 20, or 25 years. If, in the meantime, the policyholder dies he loses all claim to part in this distribution. If he holds a twenty year deferred dividend policy and dies on the day before the 20 year period expires, all the excess premium he has paid and all the compound interest on them is forfeited. Neither he nor his heirs receive any benefit whatsoever for a long, continuous, additional and needless expenditure.

Unless the policy contains a legal contract explicitly guaranteeing him a definite amount as dividends, he is entitled to receive nothing but the face of his policy, and whatever amount the officials choose to apportion him.

From a policyholder's standpoint a deferred dividend policy has no advantages. It gives no more insurance protection than the cheaper forms of policy. In return for paying a quarter more, all the policyholder receives is the possibility of getting back, after 20 years, part of the excess payments. A situation in which funds as excess premiums are placed entirely at the mercy of others, with no guarantee to the owner who has no voice in the matter of the management, or return, of both principal and interest can hardly be termed "an investment."

A deferred dividend policy was the worst form of the so-called investment policies.

The same objections apply, but to a less extent, in the case of annual dividend policies.

Participating and Non-Participating Policies.—A participating policy obligates the company to return some of its surplus in dividends declared annually, or at the end of a deferred period of years.

A non-participating policy receives no dividends, and, in consideration of the fact that the company is released from the obligation of returning any of its surplus, the premium rates are lower on this policy than on a participating policy.

For the same amount of insurance protection the premium charged on a participating policy is about 25 per cent higher than that charged for a non-participating policy. The advantages and certainty of the lower premium of a non-participating policy are not generally known to the public. Some companies refuse to issue them.

For a man who to-day desires life insurance protection, the advantages of non-participating policies are worth serious study. Briefly stated in comparison, in a participating policy one pays a higher premium and at the end of each year gets a portion of his excess payments returned to him. The amount refunded is not guaranteed and, in principle, is subject to the same objections, but to a less degree, as deferred dividends.

There is almost as much opportunity for misrepresentation, as to the amount of future annual dividends on participating policies, as formerly existed with the amount of the sum total of deferred dividends. It is as difficult for participating as for non-participating companies to find safe investments, and the field in this matter is open to both. One writing on insurance says:

> A careful analysis of the premiums after deducting the annual dividends, of various companies, of policies issued in the past show that there is very little difference in the *net* result between participating and non-participating insurance. In some companies a non-participating *rate* is less, and in other companies *the result for twenty years* in participating companies is less; but speaking truthfully, I should say that if a man should take out two policies, one in the very best and most economically managed participating company, and the other in the lowest guaranteed rate in a non-participating company, the difference in the final result would hardly buy him a suit of clothes.

If this be so, the life insurance protection being the same in each case, why obligate oneself to pay the higher premium for participating insurance? A policyholder who buys a contract should know exactly what is cut out for him; he should know exactly what he has to pay, and exactly what he is to receive. This condition is not met in any policy based on estimates of future dividends, be they annual or otherwise.

Tontine Policy.—This is a dividend policy. The holder of one of these policies, who continues to pay his premiums until the policy is paid up, shares in all the excess payments made by those of his class who started with him but later dropped out and discontinued their insurance. The excess payments made by those who drop out is shared by the company and the survivors, the survivors receiving what portion the companies see fit.

Semi-Tontine Policy.—In this policy, if a man drops out after having started, he receives back some part, but not all, of his excess payments. The remainder is distributed between the survivors and the company, as the latter sees fit.

Term Policies.—A term policy is issued for a number or *term* of years, at the close of which insurance ceases. For example, a man may insure for $1000 for the term of 10 years. At the close of this period of ten years the policy becomes null and void, and the insurance ceases. Any further insurance must be taken out anew as if the term policy had never existed. Its rate is cheaper than other forms but its benefit is only temporary, and it requires a new medical examination, and a new premium at higher rates for the increased age, to obtain new insurance. Term policies are not issued over 60 years of age.

The Renewable or Convertible Term Policy.—This is a policy in which the insured is granted the right at the close of the insurance period to renew the insurance, without medical examination, for another period or term of years *at a higher premium;* or, at any time *before the last year of the term* to convert his term policy to any other form of insurance, without medical examination, by readjusting the premium. The intention of the insured to make this change and his right to do so must be expressed in the contract, and in written application to the company before the last year of the term.

For example, one officer desiring to increase his insurance during the trip of the battleship fleet around the world, took out a convertible term policy for $5000. At the close of the cruise, upon the return to the United States, this policy was converted, without medical examination, to a twenty payment life policy for $3000. The premium was about the same in each case. The advantage was the temporary increase of $2000 in insurance during the cruise, as it had been originally intended to take out only a $3000 policy. Fooling with a term policy, however, is not recommended. It is only a temporary relief which may leave one stranded, unfit physically, without insurance.

Ordinary or Whole Life Policy.—An "ordinary or whole life" policy is one in which the insured must ordinarily pay the premiums as long as he lives. In a "twenty payment life" the policyholder in twenty payments pays a sufficient sum total to insure his heirs receiving the face value of his policy in case of his death. Having paid up in twenty payments, he pays no more during life, and his heirs get the face value of the policy at his death.

The Endowment Life Insurance Policy.—This policy is one of the most expensive forms of *life insurance protection,* as the following will show:

An endowment policy without life insurance, that is a *pure, simple, endowment,* is a contract which matures at the end of a definite period. *If the policyholder dies during this period the company pays nothing,* but if the holder of this policy (a pure or simple endowment) be alive at the end of the period the company pays the amount of the endowment, *i. e.,* the face of the policy.

Pure endowment policies, as such, are not issued by life insurance companies, but are used in conjunction with term insurance to form an endowment life insurance policy.

The endowment life insurance policy is a combination of a term life insurance policy with a simple endowment policy where, in consideration of the policyholder paying *both a life insurance premium and an endowment* premium, the company agrees to pay whether he lives to the end of a period or dies within that period.

The premium on an endowment life insurance policy is found by adding together the premium for the pure, or simple, endowment and the premium for the term insurance. For example, the premium for a twenty year endowment life insurance policy, for $1000, at the age of 32, on the basis of 3 per cent reserve, using the American Experience Table of Mortality, would be found as follows:

The net single premium on a twenty-year simple or pure endowment policy is	$447.16
The net single premium on a twenty-year term life insurance policy.	140.85
The net single premium on the twenty-year endowment life insurance policy is	$588.01
The equivalent net level annual premium for single premium of $588.01 is	$41.57

If to this annual net premium of $41.57 we add 8 per cent and 25 per cent as the loading, respectively, for non-participating and participating, we shall get the level annual office rates charged for this combination of endowment and life insurance.*

The point for a would-be policyholder to note is the fact that the net single premium for the endowment part of the policy, *i. e.,* $447.16, is more than three times the cost of the life insurance part of the contract, which cost is $140.85.

At the end of the endowment period, the policyholder may elect to take $1000 cash, in which case his insurance ceases;

* On the basis of 3½% reserve the net premiums would be somewhat less than those used in illustration.

or, he may select various combinations of cash and paid up insurance, the options in some cases being contingent upon a medical certificate of good health. Granting that any option offered him for settlement may be equitable from every point of view, what is the use, if he is looking for insurance protection, of mixing it with endowments at three times the cost of the insurance carried, and with possible failure in health during the period of the policy.

Extended Insurance.—Practically all policies have on them tables of "extended insurance." This means that if the holder of the policy stops paying his premiums, the excess payments he has made in the previous years, in the reserve, may be used to keep the policy in full force for its face value, for the number of years and days given in the table of extended insurance as printed in the policy. At the end of this period the policy will ordinarily become useless. There are several variations of this use of the reserve. They are, or should be, explicitly stated in the policy.

Character of Standard Policies.—The character of standard policies may be more readily understood if they are classified and the general truths about them tabulated, as in the following table.

TABLE OF CHARACTERISTICS OF STANDARD POLICIES.

Col. 1 Basis on which premiums are to be paid	Col. 2 Kinds of insurance	Col. 3 Form of policy	Col. 4 Period of payments, maturity, dividends, endowment, etc.	Col. 5 Method of settlement
Natural premium.	Dividends annually	Ordinary life.....	10 years ..	Cash
Single premium...	Dividends deferred*	Limited payment life	15 years ..	Regular instalments
Level annual premium	Non-participating	Endowment.....	20 years ..	Bond
			25 years ..	Annuity
			30 years ..	Continuous instalments

Roughly speaking the key to this table lies in the fact that we may select any one element, or condition, in Col. 1, and combine it with any one element in Col. 2; and, in turn, this selected combination of Cols. 1 and 2 may be combined with any element in Col. 3; and, again, in turn, the selected combination of Cols. 1, 2, and 3, may be combined with any one element in Col. 4, and so on.

* See note to p. 1262 on deferred dividends.

The resulting combination is that for which a policyholder pays, and his policy is a contract in which this combination of conditions is set forth in writing.

In further illustration of the table, assume that a man has decided to apply for a policy. On what basis does he wish to pay his premiums (See Col. 1.) The natural premium, a single premium, or a level annual premium? As practically all companies use the level annual premium method as the basis of payment of premiums, we will assume that he selects that method.

The next thing for him to consider is the kind of insurance. (See Col. 2.) Does he wish a policy on which he receives dividends, or a policy on which no dividends are declared, *i. e.*, a non-participating policy? The premium on one is cheaper than the other. If a dividend policy be selected, does he wish his dividends returned to him annually or in one lump sum at the end of a stated period?* It is to be noted that these are all matters of choice for the individual who is applying for insurance.

Having settled upon his choice of methods so far, the next question for him to decide is the form of his policy. (See Col. 3.) Shall it be an ordinary life policy, *i. e.*, one on which payment of premiums continue during life, the insurance becoming due his heirs at his death? Or does he, instead of continuing to pay premiums during his entire life, prefer to pay, in a limited number of premiums, a sum total which is sufficient to pay up the cost of the policy, his heirs at his death, receiving the face of the policy as stated above? Perhaps, instead of either form he prefers an endowment form in which, if he lives a stated period he, himself, receives the face value of the policy, or if he dies within this period his heirs receive the face of the policy. Note again that these combinations of conditions are all matters of choice on the part of the applicant for the policy.

The man who selects an annual dividend policy may prefer it on the endowment form, or if he selects a non-participating policy he may prefer it on the limited payment life form.

Having settled the foregoing points, the next thing to consider is the period. (See Col. 4.)

This does not concern the man who has taken out an ordinary life policy, for in that case both the premiums and the policy continue during life. It does concern him if he takes a limited pay-

* See note to p. 1262 on deferred dividends.

ment life policy, for in this case he must, in the beginning decide whether the premiums shall cease at the end of ten, at the end of fifteen, or at the end of twenty years.

With the endowment policy, both the premium period and the endowment period must be determined. Usually the premium period and the endowment period coincide, *i. e.*, it is usual for an endowment paid up in twenty annual premiums, to mature at the end of twenty years.

If a policy is on the deferred dividend* plan there is another period to consider, the period at the end of which the dividend is to be paid, *i. e.*, the *accumulation* period.

It is usual, however, to make all periods on a policy the same. This is desirable because of simplicity, but is not essential. It has been possible, for example, to issue a fifteen payment, thirty year endowment policy with a twenty year accumulation period. In such a case the insured would have a paid up policy at the end of fifteen years; would receive a dividend at the end of twenty years; and the amount of the insurance would be paid him at the end of thirty years.

Referring again to the table (Col. 5), we come to the methods of settlement. This takes the form of a cash payment, or any combination which may be arranged with men, life, and a sum of money as elements. The general plans are indicated in the table. The variations are infinite. It is simply a case of selecting what you wish.

The Cost.—As far as premium payments are concerned, the initial cost is indicated in the table below, which gives in even dollars a fair average of standard first premiums for an applicant aged 30 years. Each company will vary somewhat from this table.

Note that in every case in this table, except cases (a) and (c), *i. e.*, the ordinary life non-participating and the twenty payment life non-participating policy, the policyholder pays for other privileges than life insurance protection, and these extra privileges are costly. Note that the life insurance protection, in each case below is exactly the same, $1000.

The premiums of all standard companies do not vary much one from the other, and are fairly represented in the table below. The final cost to the policyholder is determined by the amount of

* See note to p. 1262 on deferred dividends.

dividends returned to the policyholder, and in this matter there is great difference in companies. This itself is to my mind an argument against taking out participating or investment policies when one is looking for insurance protection alone.

In figuring the cost of his policy, the average man is liable to overlook the effect of progressive compound interest.

TABLE OF STANDARD AVERAGE PREMIUMS (AGE 30).

Form of policy	Annual premium per $1000, age 30		Remarks
	Non-participating	Participating	
(a) Ordinary life.....	$19.00	.....	Payments continue through life
(b) Ordinary life	.....	$24.00	
(c) 20-payment life.....	27.00	.....	Policy becomes paid up in 20 payments
(d) 20-payment life.....	.....	34.00	
(e) 20-year endowment ...	43.00	.....	See remarks on endowment policies
(f) 20-year endowment ...	.....	50.00	
(g) 20-year endowment Gold bond	.....	63.00	

For example, the table shows that annual premium for a twenty year, non-participating endowment policy to be $43 (age 30), and the amount he apparently pays in cash for this policy is $43 × 20 = $860.

This is not, however, a correct statement of the cost, for his $43 annually, for twenty years at 3½ per cent, compound interest, will amount to $1258.57, and it is *this* amount he has really paid for his policy.

The value of successive annual payments at progressive compound interest should be considered by every policy applicant in counting the cost of his policy, because he doesn't pay simply an annual sum of money, but that sum annually at progressive compound interest.

That this total is quite different from the other the table below will show:

Amount paid in annually	Total amount paid in in 20 yrs. neglecting interest	Amount of Col. B at various rates of progressive compound interest		
		3%	3½%	4%
A	B	C	D	E
$20.00	$400.00	$553.40	$585.20	$619.20
Difference between Col. B and amounts in C, D and E.		153.40	185.20	219.20

As a matter of interest for those who may wish to figure a bit for themselves, the following table is given:

THE SUM TO WHICH $1.00 PER ANNUM PAID AT THE BEGINNING OF EACH YEAR WILL AMOUNT AT THE END OF FROM 1 TO 20 YEARS AT DIFFERENT RATES OF COMPOUND INTEREST.

Year	3%	3½%	4%
1	$ 1.03	$ 1.03	$ 1.04
2	2.09	2.10	2.12
3	3.18	3.21	3.24
4	4.30	4.36	4.41
5	5.46	5.55	5.63
6	6.66	6.77	6.89
7	7.89	8.05	8.21
8	9.15	9.36	9.58
9	10.46	10.73	11.00
10	11.80	12.14	12.48
11	13.19	13.60	14.02
12	14.61	15.11	15.62
13	16.08	16.67	17.29
14	17.59	18.29	19.02
15	19.15	19.97	20.82
16	20.76	21.70	22.69
17	22.41	23.50	24.64
18	24.11	25.35	26.67
19	25.87	27.28	28.77
20	27.67	29.26	30.96

The Navy Mutual Aid.—The foregoing remarks upon life insurance refer entirely to life insurance issued by companies organized to issue such insurance as a business. The Navy Mutual Aid insures on different lines, granting what is known as assessment insurance, the amount of the assessment being graduated for age up to 62 years, and there becoming level or stationary.

It is difficult to compare the actual cost of this insurance with that just discussed, because the cost will vary somewhat from year to year, depending upon the number of deaths during the year.

Investigation of the results from the statement issued January 1, 1912, showed that the assessments are nearly in proportion to the risk of death as given in the American mortality tables, and that the insurance rates were somewhat cheaper for young and old members, while somewhat higher for middle aged members than the cost of the same kind of insurance, *i. e.*, annual renewable as granted by insurance companies.

The writer has not in his possession at this time accurate data for analysis as has been done in the preceding discussion, but his conclusions are favorable to the Navy Mutual Aid as part of the insurance to be carried by a service man for the following reasons:

1. The average cost is not greater than the same kind of insurance offered by insurance companies, especially as the latter have advanced their rating for age by six years.

2. The advantage in rates rest (a) with a young man when his pay is relatively small, and (b) with the older man when he retires and his pay is reduced and fixed.

3. There is not the slightest danger in swamping the society by an excess mortality in the 62-age class, because the normal increase beyond the 62-year assessment is carried by the whole membership in proportion to their assessments, thus making it relatively small when distributed over the membership at large.

In addition, it is unreasonable, and at variance with the mortality tables, to assume that the 62-age class will experience instant annihilation by death. The members in this class are of many ages, and the mortality per 1000, as given by the American table, averages approximately 4½ per cent between the ages of 62 and 67; 6 per cent between the ages of 67 and 71; about 8 per cent between 71 and 74, etc. It is not consistent with facts and figures to assume that this class could disappear at one and the same time.

4. As far as can be determined, the relative payments are equitable and fair, under the circumstances, for all ages, and, as nearly as can be determined, each member pays every year the actual cost of his insurance, based upon his risk.

5. The argument most appealing to the writer, however, is the fact that in case of death, either at home or abroad, there is a representative of the society through whom there becomes instantly available funds and aid for a distressed and perhaps stranded widow and children. Furthermore, the society secures for the widow, without cost, the pension due her.

Conclusion.—It is possible for every service man, if he will take the time so to do, to intelligently inform himself as to the fundamentals of life insurance, and know for himself what he buys and where he stands. There are in the book stores publications on every phase of the subject. The following have been found especially *readable and interesting:* "How to Buy Life Insur-

ance," by "Q. P.": Doubleday, Page & Co.; and "The Life Insurance Company," by William Alexander; D. Appleton & Co.; and for statistics, rates, and information concerning all companies which one will instantly desire upon reading the first two books, there is recommended the "Unique Manual," published by Sampson Dawe, 501 Shawmut Avenue, Boston. These books can be bought at a total cost of $5.50 for the three. The two first named should be read together.

It is not within the province of this article to recommend any one company any more than it is to recommend a bank or trust company; nor to recommend a particular form of policy, than it is to advise as to investment. Each man can easily inform himself, if he is sufficiently interested so to do.

In conclusion, attention is invited to the fact that this article is only the record of personal reading. Through correspondence with insurance acquaintances an effort has been made to have statements correct in principles. The data used is believed to be fairly representative, although the figures used will not tally exactly with those of any one particular company.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON INSPECTION DUTY AT SHIPBUILDING WORKS.

By REAR-ADMIRAL A. B. WILLITS, U. S. Navy.

Naval officers assigned to duty as inspectors of the work done by contractors in the building of our battleships and smaller units of the fleet, may not all be experts in methods of manufacture, or details of design, but, as a rule, they do know what the finished article should embody and, from their experience afloat, they are excellent critics of the plans for the various divisional requirements, from fire room to main battery.

Sea duty impresses most strongly upon the minds of such inspectors the defects in design and arrangement with which they have had to contend, and the lessons learned through having been "shipmates" with irksome or faulty conditions often bear fruit in valuable suggestions for improvement in matters pertaining to a later design which may not have been wrought out in the light of a fairly extended criticism of the old. Especially is this true in the smaller details so likely to be continued from one contract to another, unless pointed out and bettered through the experience of some inspector who has been to sea.

The writer has had quite an extended duty at shipyards both as assistant inspector of machinery, and as senior inspector, and while confident that he knows not it all, by a very large margin, he feels that there may be some members of the "Institute" who, when ordered for the first time to similar inspection duty, may find these notes and suggestions of some interest, and, if not able to cull therefrom a full meal, will at least be able to gather a moderate luncheon. But, even if this should not be true, there still remains a certain amount of satisfaction arising from having read a *soi-disant* authority and being able to say "Nothing in it." I remember hearing someone say of a relative: "He is a wonderful literary critic; perfectly wonderful! I have seen him take up a new book, open it, glance at a single page, and say 'Rot.'"

ATTITUDE OF THE INSPECTOR.

It is remarkable how much importance attaches itself to the attitude the inspector assumes toward the contractor on taking up his duties. Personality, of course, figures greatly, but even with a natural inaptitude for "supervising without directing," an inspector can make or mar his general success by his official pose. To a first time inspector there is a weight of responsibility for results which quite naturally makes him wary. He believes himself to be a detective, not only of bad workmanship, but of secret designs of the contractor to get ahead of the government in mysterious and well-designed schemes which it is his duty to lay bare and frustrate. Hence he cannot permit himself to be reasoned or cajoled into acquiescence in, or recommendation of, a proposal for even the simplest of changes without profound study of all the possible bearings it may have upon the contract or the profits of the contractor. This, of course, wears off to smoother running conditions with time and experience; yet, with some, it never does give place to either a confidence in the intention of the contractor to give a fair return for the dollars paid him, or to that greater confidence that no bad feature can possibly be "smuggled in" under a simple and practical system of supervision.

The attitude most desirable for an inspector to assume is that of a co-worker with the contractor for the purpose of securing the very best possible results. This enhances his value both to the government and contractor in a measure quite impossible to be appreciated by the wary, detective sort. When an officer assumes duty in this co-ordinating spirit he does not for a moment weaken his guardianship of the interests of his office, but distinctly adds to it by the reciprocal candor and extended privileges educed from the builders by such an attitude—and instead of being considered a hindrance to effective work, he is looked upon as a real helper, and is esteemed as a valuable assistance to progress in, and excellence of, construction.

The two poses so very opposite in effect, and yet both quite consistent with carrying out the duty fully, may be described as follows: First (and worst), the inspector contents himself with passing judgment upon all work submitted for his criticism or discovered through his vigilance, and placidly demands his "pound of flesh" as explicitly agreed to by the terms of the contract, and

described on the drawings and in the specifications. In cases of defects in material or workmanship, these are broadly condemned for slightest deviation. It is as if he were to say to the contractor, "You have engaged to build a ship in strict accordance with a detailed description of its elements and accessories, for a certain price, and I am here to see that you do it." In this spirit, and with the power or authority given the inspector, rejections are frequently made for literal and not material departures from the specifications with the result that most of the minor cases of needless condemnations stand, while, in more important cases, appeals to the Department or Bureau concerned for re-consideration, are forced to be pushed by the builders in order to save themselves from unreasonable losses.

This same spirit is also carried along in the correspondence connected with forwarding plans for approval. Drawings submitted are examined, and a list of the points of difference between the specifications and plan is made out and the whole forwarded only with the certainty of increased correspondence before approval can be secured. Delays through this cause are equally expensive to the builder, as those created through bad judgment or peremptory action in the matter of passing upon material, and indeed often much more so. This pose cannot be objected to on any legal ground. The inspector is doing his duty as he sees it but, under such conditions, an atmosphere of distrust and antagonism very soon surrounds the office in all its workings, and through this it becomes continually more difficult to see clearly; neither is it probable that the inspector will gain much voluntary assistance from the contractors under such a system, in discovering any defects that can be concealed without danger to a successful trial trip.

The second and best pose is one where the inspector's view of the situation may be expressed thus: "The contractors have entered into a contract to build a ship of best material and workmanship, and in accordance with explicit plans and specifications, and I am here to help them do it."

FIRST DUTIES OF AN INSPECTOR.

The first duty of an inspector assuming charge of any division of the work of construction of a naval vessel, is to familiarize himself with the "tools of his office," and those upon which the

contract is to be accomplished. This is not the work of an hour or a day, but must be a part of the proceedings of each day during the period of his novitiate, until he knows the principal men he has to deal with, not only by name, but also by "outline"; which means a mental sizing up of their individualities and abilities. These first impressions are sometimes quite misleading and therefore should be labelled "For test," and stored in the back part of the head and not voiced to anyone. Most frequently false impressions come through those who are the glibbest talkers and most plausible generalizers, and the inspector or contractor feels that here at least he has met one "dependable." Well—there is no use looking for trouble, and experience will never be exactly similar, but it may be put down as an axion that it is the part of wisdom in getting "acquainted," to talk as little as needs be, either regarding one's own deficiencies in the special work, or in vaunting a wide knowledge in the duties involved. The truth "will out" in ample time for all practical purposes.

Some inspectors personally prefer to conduct all intercourse with the contractors in a formal manner and by letter, whenever this is at all practicable, meeting the chief officers of the company as seldom as possible. This is supposed to lend a dignity to the inspector's office and to extract a deference from the builders which protects the best interests of the government. This is certainly a mistake and tends to delay work to a most serious degree. As it is, however, entirely in accord with the red tapeism of Navy Department work, and leads to an orderly and systematic consideration of every step, perhaps I should have said that, instead of this being a mistake, the reverse policy will be found to be an improvement and one that will greatly advance the business of the office and the completion of the vessel, and will not detract from any dignity of office that is worth possessing. Indeed it is considered most important to early pave the way for ready and agreeable personal discussions of the many points of difference constantly arising and upon which a free exchange of views is most desirable, before proceeding to letter writing, as such discussions often obviate the necessity for writing any letter at all on that particular subject or issue.

With the general manager and shop foreman the clearest understanding should be had from the start in relation to concealment of defects. It is not possible, with all the lynx-eyed assistants

ever yet allotted to the office, to prevent the concealment of some defects, some time. With all the penalties for failure to meet the contract stipulations, it is obvious that no defect that would probably militate against a best performance would for a moment be permitted by the builder to remain if they knew it, but there is another class of defects which may not prevent a perfect trial trip performance, but which would shorten the "life" of a part of the machinery, and cause the expense of removal long before a perfect casting or forging would have to be replaced, and of which these notes will treat later on. As, however, the government is paying for the "best material and workmanship," and as we are detailed for the duty of seeing that this is given us, there is no defect, however slight, and (perhaps) unimportant, that should not be instantly reported to, and passed upon by, the inspector. Therefore, the plain understanding at the beginning must be that the discharge of the immediate supervisor of any workman failing instantly to report a defect as soon as discovered, will be absolutely insisted on. Then make a case out of the first offense without recourse.

First duties include the reading of such contracts as may be in hand carefully, but the study of the specifications, so eagerly begun by many inspectors should be done piecemeal and (except for the general descriptions and those principal data which are needed for notebook and ready reference), only at such times as the particular part is brought up in submitting the detail drawing thereof for the inspector's criticism and the approval of the Bureau.

If the inspector is establishing a new office, of course the arrangement of his office force will be a primary requisite, and should follow the needs as shown under the next heading in these notes: but it is scarcely probable that such original duty will fall to the lot of many naval officers for years to come, or until this need of a fleet of the air will permit some of the middle states to go heavily into the shipbuilding trade and establish dock yards on mountain tops. Generally the office will be one already established, and in this case it is most advisable to make it one of the first duties to briefly study the scope of the work done by each of the force through personal queries, in connection with a scrutiny of the papers and methods at each desk. This will put the inspector wise to the comparative amounts of work done by each individual as well as post him, as nothing else could, in the range of

duty included in his office and its status at the time he assumes charge.

The writer would like to impress this upon the mind of the first time inspector as something which is not always done, but which it will surely pay him to do. Often an office force that has been running smoothly for some years will hold itself above the plane of criticism from a novice and will rather try to convince the inspector that he will do well to let the wheels alone and not waste time in securing explanations of the details, and that he will gradually become familiar, etc.: But what the inspector wants to know, and should know, is just what work is being done by each of his force—not for criticism at the time, but for his general information and the satisfaction resulting from knowing all the compartments of his command just as the knowledge gained by the captain of a ship, through his regular inspections, gives him a greater confidence in his control.

It is usual for an inspector to begin his duty with a note book in which he enters many memoranda, and from which he expects to derive much benefit later on. It is perhaps dangerous to decry the note-book habit, yet it is most certainly true, that it has not the value so commonly attributed to it. The only notes of actual worth (barring exact data and tabulations) are those which can be and are acted upon or filed and indexed at once, or that can be stored in the back part of the head in its proper cell. A note book full of miscellaneous memoranda, "for future reference," simply makes a fool of itself in the inaccessibility or unserviceability of its contents. Such notes are seldom explicit enough to be thoroughly intelligible after the unwritten contexts are forgotten, and as they are not indexed, the maker usually spends more time in futile search for an ancient jotting than is at all commensurate with its value.

The note book, however, has its field of usefulness for the sketches and data which should be entered systematically and in handy form, will give the inspector an accurate ready reference record of the most important features of the work in hand.

A few examples of what is considered of value for the pocket memorandum book are given in Figures 1, 2, and 3, taken from the writers loose leaf book used during his last tour of duty at a shipbuilding yard. The figures are photographic facsimiles of the original leaves, and therefore show both the size of book and the

Name Cont. #	Utah 80	Arkansas 97	McCall 78
Contract	11-24-08	9-25-09	10-5-08
" Price	$3946000.	$4625000.	$665000.
To be Complete	7-24-11	5-25-12	10-5-10
Keel laid	3-15-09	1-25-10	6-8-09
Launched	12-23-09	1-14-11	6-4-10
L' x B'	521 x 88	554 x 93	289 x 26
Mean Dft.	28'-6"	28'-6	8'-4
Displacem.T	23000.	26000.	742.
Speed Contract B	4 hrs - 20 3/4	4 hrs - 20 1/2	4 hr. - 29 1/2
Speed Contract C	24 hr. - 19	24 - 19	12 - 25
Speed Contract D	24 h - 12	24 - 12	10 - 16
Penalty B	$25000. 1/4 Kt.	$25000 1/4 Kt.	$50000. per Kt.
Water per S.H.P. B	15 lbs	14.87	15.5
Water per S.H.P. C	16 1/4 "	15.77	17.
Water per S.H.P. D	26 "	25.58	27.
Penalty B	$10000. per lb	$10000. per lb	1000. per lb
Steam pres.	185.	185.	240.
Air pressure	2"	2"	5"
Weight Mchy	2060. Tons	2095. T.	272 1/2 T.
Penalty per Ton	$500.	$500.	$250.
Type Engines	Parsons Turb.	Parsons Turb.	Par. Turb
" Boilers	12 - B&W	12 B&W.	4 Normand
Est. Cost Mchy	1,100,000.	1,100,000.	390 000.
No. Shafts	4	4	3
No. Rotors	8	8	5
S.H.P. Est.	30000.	35000.	12000.
R.P.M. "	380	330	775.

FIG. 1.

Illustration of note book data. Generally two pages will embody all the frequently used data.

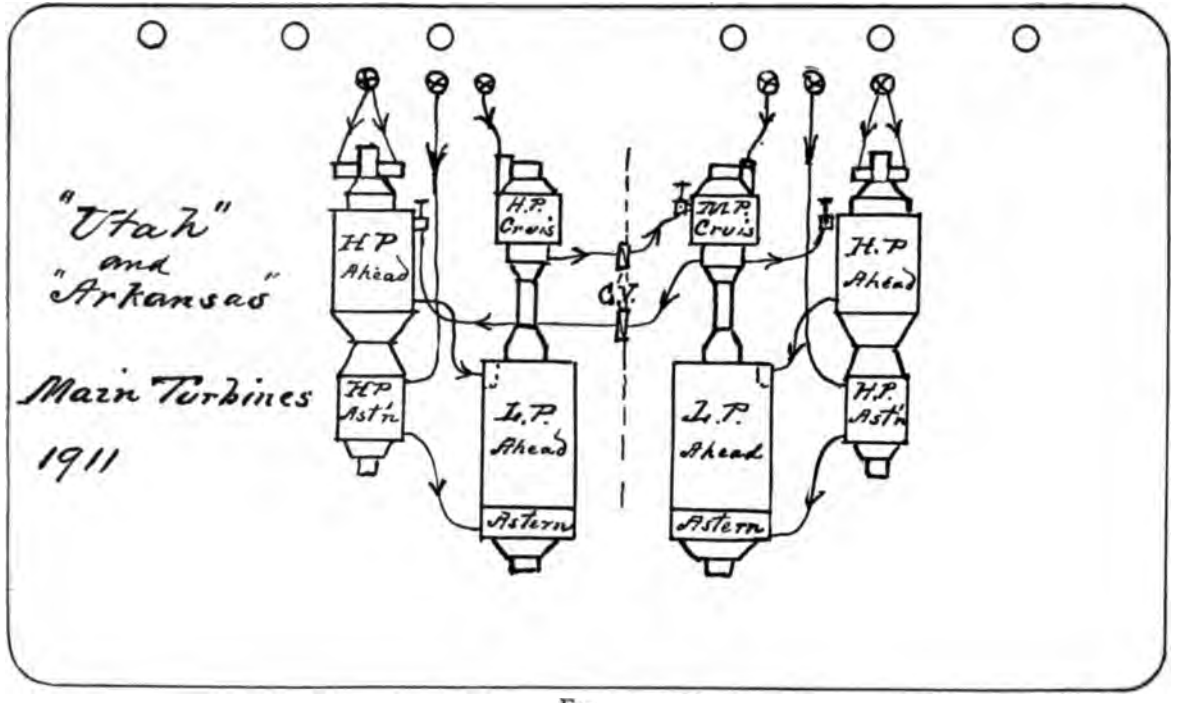

FIG. 2.

Free hand note book sketch, showing the three arrangements for using steam in battleship turbines. 1st, to H. P. ahead and L. P. ahead direct; 2d, to M. P. cruising, to H. P. ahead and to L. P. ahead; 3d, to H. P. cruising, to M. P. cruising to H. P. ahead and to L. P. ahead. Pipe lines should be in red ink preferably.

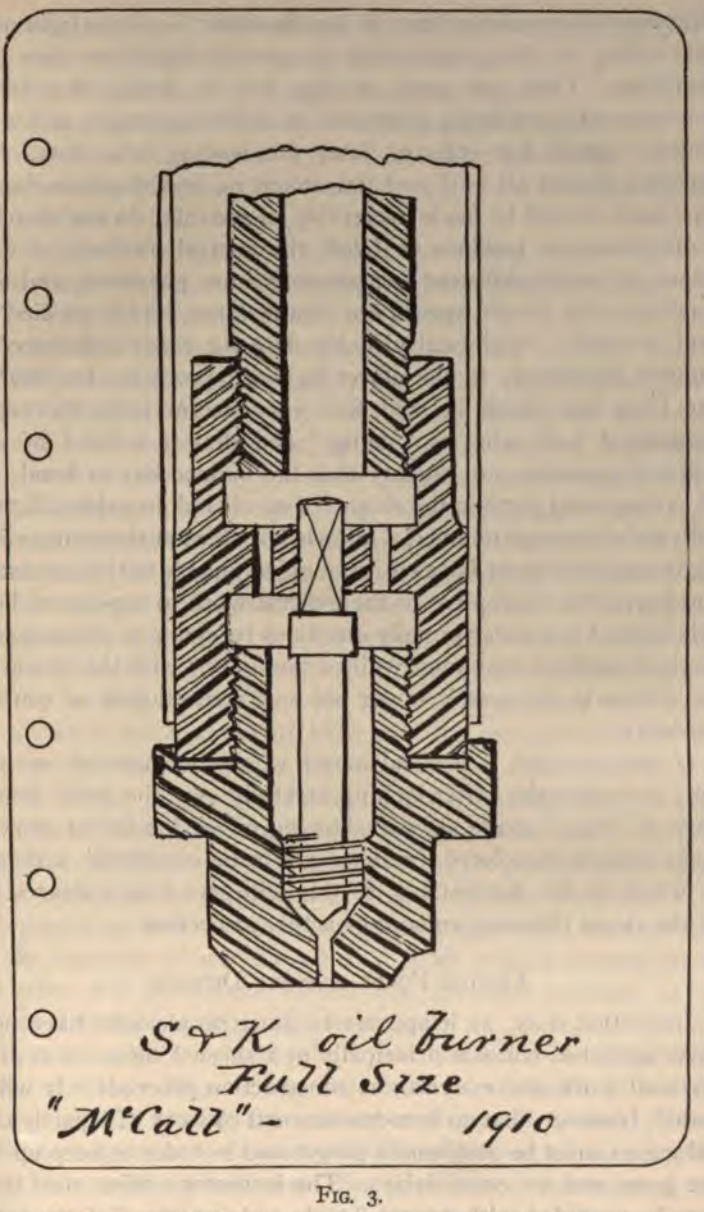

FIG. 3.

Free hand note book sketch illustrating character of work recommended for novel features desirable to make familiar. This burner was used on McCall & Burrows under the inspection of the writer. Use no dimension figures in full size sketches.

character of the entries; they do not, however, show the light quadrille ruling of the pages which so greatly facilitates free hand sketching. Only one page of ship data is shown, the further extension of these being continued on following pages, and which include spaces for entering later the leading trial data. The sketches should all be free-hand, inked in, and the lines for the pipe leads should be made preferably in red ink. In the sketch of arrangement of turbines of *Utah*, the several methods of using steam, by which different "expansions" are governed, and fixed conditions for certain speeds are obtained, are readily studied and kept in mind. Additional valuable data for ready reference will suggest themselves to the officer as work proceeds, but there is one little list which he will find very useful until thoroughly acquainted with what is "doing," and that is a brief of each contract (number and object) that the builder has in hand. As all castings and parts in the shops are numbered, in painted figures, with their contract number, a knowledge of what these mean is of legitimate interest as far as it is not objectionable to the contractor, and keeps the mind alive to the general work to a point of being able at least to answer broadly questions referring to any imposing piece of work in the shops, while a familiarity with the number of the contracts for vessels under his own inspection is of course a necessity.

If any contract is well advanced when the inspector assumes duty it is advisable, after looking carefully over the work done, to have a "brief" made at once showing either the list of principal parts already completed, or those yet to be completed, according to which is the shortest list, as this will give him a clearer idea of the status than any amount of actual inspection.

OFFICE FORCE AND ITS DUTIES.

Inspection duty, as it appears to most people who have never investigated it, consists principally in a shrewd supervision of the physical work and material, as construction proceeds. It will be found, however, that an immense amount of work of a partly clerical nature must be continually progressed in order to keep up with the game and not cause delays. The inspector's office must therefore be provided with proper "tools and facilities" if the results of his work are to be worth while. This office work covers the following duties:

Correspondence. This should be separate and complete for each contract whether the vessels are alike or not.

Filing, indexing and keeping attendance records.

Checking up detail drawings and indexing file copies.

Preparation of papers in connection with "payments."

Preparation of estimates of costs of approved changes for use by the "Board of Changes."

Calculation of weights and tabulation of actual weights.

Checking finished tracings and the reduced plans for booklets.

Preparation of data for Trial Trip Board.

Reports and tabulations of all tests made, and

Writing up journals for each vessel under construction.

Correspondence—Clerical Work. Where more than one vessel is under construction (except, of course, in cases of the smaller types, or when there may be two or more destroyers exactly alike) there should be a chief clerk, who is a stenographer and typewriter, and an assistant who is a typewriter. These two men can attend to all the correspondence and typewriting necessary, and can keep up the index and file records properly, if the work is systematically arranged. It should be a duty of the inspector to interest himself in the regulating of the office work in order to prevent, as far as possible, the frequent recurrence of "Field Days," when the disorder of haste and the recriminations of the tardy or lax may make an undesirable and really unnecessary exhibit. This proper regulating can be accomplished in only one way, and that is by requiring an advance to be made wherever possible in all data collection necessary for the proper preparation of papers known to be ultimately needed, and the preparation of such papers as soon as the information is obtained. To facilitate this the inspector should have posted at all desks a briefed list of just what will be wanted in this line for each contract, as an obvious discourager of the idle hour.

In an extended experience the writer has found the office force of an inspector's office no less inclined to procrastinate in matters not immediately urgent, than are other groups of mortals. True, when the time came for rush work there was a very loyal response to the call, and they performed that miracle, so common to us all, of "just getting the last paper completed in the very last minute" possible to allow. Perhaps this variety is not a bad thing, and that it does the mind good to be "put to it" once in a while, but it

is not in accord with the rules of efficiency, and we must keep everything up-to-date in office work if we would get best results and appear to best advantage. The rush times will come in spite of all that, but they will be legitimate and not bastard.

Especially there should never be permitted any preventable procrastination in filing and indexing papers and correspondence. This putting off until a leisure day, is wrong in principle and detrimental to dispatch of work, and the effect of having to await a search through several piles of documents, or a drawer full of mixed letters, for a paper urgently needed is, at least, not soothing. If the inspector will insist on completing the filing, each morning, of all accumulations of the preceding day before general work is taken up, he will be surprised at the ease with which this is accomplished, and pleased with the knowledge of being able to secure at once any record he may want that has passed through his hands or office. In this connection it is well to remember that often papers will come in for forwarding, of which it may not be deemed important to keep more than a copy of his endorsement. He should not lightly judge of this, but should at least dictate a comprehensive extract (often better, because briefer, than the original) and file with the forwarding endorsement.

The periods of greatest activity on the part of the actual clerical force of the office is when a trial trip approaches, or when two or more requests for "payments" are suddenly sent in. As a rule the chief clerk keeps in touch with the contractor's intention regarding applications for payments, and can begin getting up his papers fairly in advance, but it is not always possible to prevent rush work at these times. The contract price is paid the contractors generally in fifty separate payments, whenever the material bought and received and the work done amounts to a sufficient sum. On the contractor's part the vessel is kept insured to its value as advanced, and reserve payments are held at the end until acceptance is final.

The papers forwarded to the Department with each application for payment appear to be excessive but perhaps are really not so. With a letter of transmittal the inspector of machinery, for instance, must include the letter of the contractor advising that they have made application for the particular payment; an itemized statement from the contractors (under the principal divisions of the work) of total amount of cost of labor, and material furnished

to date of application which they desire to include. A certificate (or copy) from the sub-contractors for boilers, showing how much they have received from the contractors on account of work done; an itemized statement from the inspector under the principal divisions of the work, showing condition of work in percentages accomplished; a formal estimate of total weight and cost of material, and cost of labor for work done to date and for material on hand yet to be incorporated; a letter showing amount of material received from the makers of the boilers; a public bill signed by inspectors of hull and machinery covering the payment asked for; affidavit from the treasurer of the shipbuilding company relative to the absence of liens against the vessel; and affidavits relative to the work having been done under the eight-hour law.

The time for requesting payments can generally be managed so as to utilize the regular monthly reports showing percentage of work accomplished, and thus obviating separate calculations for an intermediate report of this kind.

The papers neccessary to be prepared in connection with the trial trip of a battleship indicate in a greater measure the amount of upkeep work in data collecting that is referred to above as not to be put off any longer than is compulsory from lack of available information. I quote the list of papers for the *Arkansas* as a good example, and believe simply from the consideration of these items one can gain quite a comprehensive idea of what inspection duty covers.

The list is as follows:

PRELIMINARY OFFICIAL TRIALS; INSPECTOR OF MACHINERY SUBMITS CERTIFICATES, REPORTS AND OTHER PAPERS TO THE PRESIDENT OF THE TRIAL BOARD.

Certificate of the exact weight of machinery under cognizance of the Bureau of Steam Engineering, in accordance with the contract for the above-mentioned vessel.

Certificate that the machinery is strong and well built.

Certificate that the machinery is complete in accordance with the contract.

Certificate of the calibration of feed water measuring tanks.

Certificate regarding quantity of bagged coal, and weighing of same.

Certificate of tests of ash hoist engines and gear.

Certificate of tests of engine room signal gongs.

Itemized list of unfinished work under cognizance of the Bureau of Steam Engineering.

Itemized list of work under cognizance of the Bureau of Steam Engineering (Electrical) to be completed by the government after delivery of the vessels.

Recommendations and suggestions to the Trial Board regarding alterations and additions.

Table of tests of steam and vacuum gauges.

Reports of tests of auxilaries, as follows:

Horse-power curves of auxiliaries.

Test of ice machines and cold storage plant.

Test of workshop tools.

Test of generating plant (48-hour).

Quantity of fuel oil on board, and method of measuring.

Calibration curve of Gary-Cummings Torsion Meters, and affidavit regarding correctness of same.

Calibration of main engine shafting, and shaft horse-power constants.

Propeller measurements.

Synopsis of machinery and hull data, Bureau of Steam Engineering Form No. 77.

Coal bunker measurement calculations, and capacity curves.

Certificate of boiler safety valve setting.

Test of evaporator and distiller plant.

The Detailed Drawings and How Handled.—The Department's contract plans upon which the estimates for bids are made do not exhibit the details. Outline and general arrangements are shown, to be read in connection with the specification describing material and sizes of main parts, but making the detailed drawings for each part is the business of the contractor, and it is in working out these details that the skill, experience, and engineering ability of the contractor's designing force is brought into the lime light, and makes for superior or inferior results. The tendency naturally is towards conservatism, and it will be found that radical departures from known "good enough" designs, that are acceptable to the government, are few and far between, simply because of the greater safety in play of that kind. It is up to the contractor to realize such results as will avoid the penalties noted in the contract for defect and default, and it is for this reason, and for lack of funds for large experimental work that we are slow to initiate, generally following the more venturesome and enterprising engineering of the "other side" instead of leading.

Hence the majority of detailed drawings of machinery submitted by a contractor for approval are similar in design to approved drawings for former vessels, modified only in dimensions. The detail drawings, as completed, are sent to the inspector, each

accompanied by a letter in duplicate, in which should be stated all the departures from the specifications embodied in the plan. This, however, is not always done, and while it is of great advantage to have the drawings presented with this information, it does not relieve the inspector from the responsibility of the completeness of the list, and which compels him to have a most careful scrutiny made by the draftsman in charge of checking up these details. It is at these times that the inspector particularly studies the specifications and it is of the highest importance that he has the assistance of a very superior marine engine and boiler draftsman (for machinery office), and an excellent electrical draftsman for the electrical equipment, to make these careful studies and bring to him a synopsis of discrepancies found that are not simple mistakes of the contractor's draftsman, readily corrected. The drawings could go forward formally, simply calling attention to departures from the specifications and recommending approval or disapproval, and putting the detail up to the Bureau for further study; but a preferable method of handling this work can best be shown through the following slightly digressive paragraphs.

The inspector will find that as time goes on inquiries will be made of him by the contractors, by letter, as to why certain drawings, submitted weeks before, are held up, and he will perhaps find that these either have only just been forwarded to the Bureau or are still piled up on the waiting list. Sometimes, of course (although seldom), the delay is at the Bureau. Such inquiries are annoying and compel definite reply or explanation, and no inspector cares to say it is because he is short handed or over-crowded if he can avoid it, because with proper distribution of work he may not be. The facts will usually put the real blame on the contractor for sending in drawings in bunches instead of in a fairly continuous manner, and putting on an overload for which the office is not rated. The real cause, however, is lack of co-ordination between the inspector and builder in the designing work.

If the inspector shows a keen interest in design and is tactful, he can make himself *persona grata* to the designing department of the contractor and, by avoiding all supercilious criticisms, can gain a foreknowledge of what is to be submitted that will be most helpful in expediting the final approval. In fact it would be of greatest advantage if the chief draftsman of the inspector's office could always go over with the chief draftsman of the contractor

all new designs in the pencil, before tracings are made and prints struck off, and note or correct all discrepancies at this time. To all novel features the inspector's personal attention could then be called and a brief discussion secured, while if the inspector, through his personal experience has suggestions of value to offer at this time in direction of overcoming some inconvenience or difficulty in actual service, he may be sure of an intelligent hearing and a cheerful willingness to change if it is really an obvious improvement. There can be no question of the mutual advantages of this co-ordination, in getting before the Bureau drawings with a clear and full criticism, and with intelligent and reasonable recommendations, and not simply present the data and let the Bureau hoe its own row in deciding, or have the contractors personally discuss with the Bureau, in improving the inspector's value as a just critic.

The standard size of drawings for machinery (27 x 40 inches or multiples of that size) permits drawing in arrangements and details to a good working scale and allows most of the details to appear on the same sheet as the assembled part shown. The titles should be clear and in large type in lower right-hand corner, the drawing number in particular being made in larger and more prominent figures than the balance of title subject matter. A good system for numbering is to give every contract a number and incorporate that number as a prefix to the drawing number. Should there be many parts to a contract a composite drawing number is most useful, *e. g.*, drawing number 100-500-5 would mean contract 100, section or part 500, sheet of that part 5.

This facilitates tracing work in the shops and in the records of the drawing rooms, general offices and accounting department. The scale should always be sufficiently large to enable all dimensions to be easily read, and dimensions should not be unnecessarily repeated. This mistake in putting all possible dimensions on each view of a part has led to many shop troubles and losses through using the wrong dimension, for, in checking up drawings, it is frequently found that one dimension is not correct, and in changing this the draftsman sometimes overlooks the correction of the same dimension in another view, and the uncorrected dimension is the one which the workman, through some blind fatality, will be sure to use.

Finished drawings for filing and permanent record must be made on the glazed side of tracing cloth and must be veritable tracings in good India ink, of the original drawing with all connections or approved changes shown thereon. The original drawing is of course in pencil, and is generally traced off for the purpose of securing blue prints to submit for approval and for shop use, but a careful and skilful draftsman can design in pencil on the dull side of tracing cloth and ink in the original for printing purposes, or in cases of sketch work, secure blue prints from the pencil drawing and save much time thereby.

Cross hatching for "sections" is far preferable to coloring, as it shows up so postively on blue prints and renders them much easier to read in the shops. It is our custom to resort to coloring very seldom, although abroad the opposite is the case, and coloring is applied to a great majority of drawings and prints, quickly, and by a trained force of young people at low wages.

Each drawing is required to have shown upon it a complete "list of parts," and each separate piece of a detail drawing must have a "piece number" clearly printed and "tied" to it by reference line. There is no uniformity in the practice of the several shipbuilding stablishments relative to the data and arrangement of this list of parts, nor is the inclusion of calculated weights adopted by any of them. In reference to the work of making out weight sheets noted under the next following section, it will be readily seen that such a column, if filled in on all detail drawings submitted, would be found most useful as a comparative check on the work and, besides this, the ever present weight record of each part of the machinery, on the drawing of that part, would most obviously be of great and frequent value to the engineer officer of the vessel, and to any one "reading" the drawing for full information. Some shipbuilders use the term "mark" for "piece number," and some put in column for weight with nothing in it. A model scheme for this list of parts would be headed "List of Parts for One Complete Ship," and would have the full data in columns under the following headings and sequence: Piece No., Name of Part, Number Required, Material, Pattern or Die No., Est. Weight, and a head column for Remarks. All other data, found useful only to the builder in his work, should be excluded from the detail prints and finished drawings furnished the government.

In checking up drawings (blue prints) with specifications and record of approved changes, it is a good plan to use a yellow pencil for marking errors or questionable points, and a red pencil for checking off the correct points.

The following scales should be used in preparing plans: ⅜-inch and ½-inch for general arrangements of piping showing details; ½-inch and ¼-inch for general arrangements of piping showing outline only; 1-inch and 1½-inch for assembly arrangements of engines and machinery; not less than 1½-inch for details of engine and machinery parts, 3-inch being more generally used than any other. All lettering, figuring and dimension lines should be clear and distinct, a square hand being preferable on account of being more easily read. No colored inks should be used. Where possible, dimensions should be given outside the figure, especially if the figure is in section. When the drawing is not to scale the dimension should be underscored by a heavy line so that the discrepancy is readily noted.

An office record print should always be retained of each plan submitted, and upon this should be recorded date of receipt from contractors or outside party, date of return to same. Letter number, and date of, and office file number. This does not entail much additional work if a rubber stamp is used for this date with properly arranged headings, while the great convenience of the record and time saved in searching files thereafter is obvious.

Changes.—It will be found that the one impossible thing to do is to have a contract carried out exactly as originally specified. With the constant advance in the mechanical arts, and the improvements that are continually being devised by those whose minds are devoted to such work, there are always some features of the specification for a warship which, between the time of their compilation and that of their practical application, develop "wrinkles" or some other signs of approaching senility, or else are shown to be unnecessarily complicated. In such cases changes are prepared either by the government or builders tending to improve matters, and each of these changes is treated separately and in detail as effecting the cost of the work. As soon as the Department approves of a change it directs that the matter of its cost be referred to the Board of Changes, which is a conference of somewhat permanent character, meeting at such times as the accumulation of pending subjects demands, and deciding upon the amount to be

deducted from or added to the contract price for each change approved.

Before this board acts upon any item the inspector has prepared a detailed estimate of the cost of the new arrangement or modification, as well as the probable cost if the work was done as originally specified, and this preparation requires good judgment, mechanical experience and a knowledge of current labor and material costs. It is a part of the duty of the chief draftsman of the inspector's office to work out these estimates, independent of the calculation of the contractor, as, although a stated sum has been given by the latter in the proposing or accepting letters, the legal adjustment is the answer of the board, and the proper estimate becomes a matter of serious consequence as regards the final cost of the vessel.

In deciding the final amount of increased or decreased cost for any change, the board listens to the argument of the contractor's representative and his statement in detail, as well as going over carefully the office estimates, and it is therefore necessary that these estimates be presented clearly and logically; and in this work the inspector will soon realize the value of his chief draftsman.

Sometimes it happens that, while the cost of an approved change is less than that of the originally specified work, the resultant modification is of such distinct benefit to the vessel and the government as to entirely offset the deduction, and it is the duty of the inspector to make such recommendations to the Department or Bureau concerned as will bring the fairest treatment to the contractors possible, under all the circumstances of the building. This effect on the value of the completed ship is not always considered as broadly as it should be, and while there is danger in any loose method of dealing with changes, the reasons for, and the final effect upon, efficiency should count in special alterations, with decided favoring of the contractors in cases of doubt. All changes are in line of improvement, and where a contract is made to build a vessel according to a general design and a detailed specification, and the contractor can greatly improve upon that design in some detail and show a better result than was called for, either by a simplification or modification, it gives him little encouragement in such effort if a corresponding reduction is made in the amount paid him, due to an estimated reduced cost to him in the physical incorporation of the change. One may imagine such cases arising, as the writer has

realized them, and while most of the changes are minor or do not come in this class at all, it would appear that in the class referred to an estimate on the value of this new design itself could well be considered by the board.

Weights.—When one considers the vast number of elements comprising a modern battleship, and realizes even in a modest degree the calculations necessary to produce such a vessel of a displacement closely predetermined, and a speed within a fraction of a knot of that stipulated, he can, while marveling at the accuracy of the designs and the wonderfulness of the results, appreciate the importance of estimated weights for every part and their approximate coincidence with the actual. No such results as are now possible could have been approached without a vast collection of correct data, and their arrangement and tabulation in groups so as to permit handling the many details in "blocks" as it were, and estimating the weight of groups from a knowledge of their components. In machinery where the varieties of appurtenances are manifold and where the main engines themselves have changed so completely during the past decade, it is most essential that each contract shall contribute its share of accurate information regarding relative weight and power so that increased facility shall be given to the work of designing new vessels to meet desired requirements.

The estimates for weight of machinery of the several types are made upon previous results and their indications, and are approximately as follows: Reciprocating machinery for battleships and heavy vessels, with the B. & W. boilers, 10½ horsepower per ton of machinery; turbine machinery for same class, 15 horsepower per ton of machinery, while with Express type of boilers and turbine machinery for destroyers it is estimated at 25 horsepower per ton. To preserve a proper regard for the importance of this feature, there is attached to each contract a penalty for overweight of machinery, the upper limit being stipulated clearly in the contract, so that builders are mulcted $500 per ton of excess of such weight for battleships, and half of that for destroyers, and the actual weight of every piece entering into the construction is ascertained most carefully before it is put in place.

It is the inspector's duty to secure the record of the weights as the parts are prepared, and for this purpose he must not only have a weight clerk present at the scales, but must check up from the

drawings by estimating the weights of all the details of parts that are built by contractors, and not bought or installed in an assembled unit susceptible of being weighed and tabulated as such a separate item. These are, however, listed so as not to overlook any piece in obtaining the weights from the records, yet even with all these precautions some remarkable instances of omission have occurred, such as leaving out entirely the weight of one smoke pipe—the error being caught by comparing weights with those of a sister ship building at another ship yard.

A good engine and boiler draftsman is needed for these calculations and the proper tabulation of weights in groups, and his exactness and care will save a world of trouble such as comes when the reported weights on board do not at all account for the draft. The groups referred to for these weights are:

I. Main engines, casings, etc.
II. Shafting and couplings.
III. Line and propeller shaft bearings.
VI. Main condensers.
VII. Main air and circulating pumps.
VIII. Propellers.
IX. Boilers.
XI. Uptakes, smoke pipes and guys.
XII. Steam and exhaust pipes and valves.
XIII. Suction and discharge pipes and valves.
XIV. Lagging and clothing.
XV. Floorings, gratings, etc.
XVI. Auxiliaries.
XVII. Fittings and gear.
XVIII. Water.
XIX. Stores, tools and spares carried on board.
XX. Miscellaneous machinery.
XXII. Connections to other miscellaneous.

It will be found that the weights added to or subtracted from the contract weight through approved changes sometimes even up quite fairly. As an illustration there were 30 approved changes in the machinery of the *Arkansas,* which involved an increase of 60,830 pounds, and a decrease of 47,775 pounds, leaving but 13,055 pounds, or 5.825 tons to add to the 2095 tons specified in the contract, through this cause.

Finished Tracings.—Where there are several contracts active under the inspector, it will be necessary to have another draftsman to check up the finished drawings which the contractor must furnish at the end of each contract. These sets of carefully made tracings must be of standard size and embody every change approved or made, and otherwise accurately show the object as actually built, and when one realizes that there are between 1200 and 1300 plans for a modern battleship (hull, machinery, ordnance, and equipment), he will understand the magnitude of this work. In making these tracings the contractors, knowing that the inspector must check them up, often fails to make a proper effort to discover all mistakes or omissions at first, and the inspector will do well to insist on care in this particular, to avoid delay and the return of tracings to them for correction. From these finished tracings all the blue prints are made for issue to the vessel and to the various yards, and mistakes, if allowed to remain, would possibly be productive of serious consequences.

Booklets.—It is customary now to require a set of reduced size drawings of general arrangements, pipe plans and such of the details as are most liable to be in frequent use, and have them lithographed and supplied by the contractors in flexible cover booklets for handy reference on board ship. These must be also carefully checked up as they are not always photographic reductions of finished tracings, but are made specially to clearly show certain distinctive features or plans on each sheet.

SHIP AND SHOP INSPECTION.

The details of office procedure, while necessary to the work, do not appear to the future inspector to be as important a part of the duty as does the actual physical inspection of the material and workmanship entering into the construction of the vessels under his charge. In this latter work his responsibilities seem entirely practical, and his guardianship of the public interests here has its final exercise with no possible recall of decisions. Let us, therefore, define as closely as possible the proper lines upon which he can proceed with safety, and at the same time see how he is assisted in the prevention of unsatisfactory results. Anyone, however, expecting to find in these notes a clear and definite guide through all the "maze" will be disappointed, because "there ain't no such animal."

While the good inspector becomes so through experience, a study of the requirements, and a common sense application of these to the work in hand, assurance can be given the inexperienced which should be of comfort, and that is that if the inspector will bear constantly in mind that nothing but the very best material and workmanship will satisfy the contract, he will be saved many a period of uncertainty; and possibly also of regret and anxiety at having accepted something doubtful through a too lenient consideration of the losses of the builders attendant upon the condemnation of an expensive part. He must remember that nothing has done so much towards bringing material and shop methods up to their present excellence as has the framing of high grade specifications and compelling the contractors to live up to them through having the work supervised by officers; men devoted to the interests of the government and beyond suspicion of corruption or of venal laxity. These inspectors, by their consistent rejection of inferior or defective material or workmanship, have made necessary on the part of designers, manufacturers of material, and of shop supervisors, a continuous study of the possibilities in improvements which has resulted in production of such uniform grades of material which, at the time of the writer's first duty at a ship yard, would have been considered absolutely impracticable; and has also revolutionized design and workmanship in marine engineering construction. Therefore, it will be seen that while rigid inspection is, at times, mercilessly cruel to the immediate gain of the builders, it nevertheless ultimately works to their highest advantage, and adds each year to their ability to produce better and more perfect results.

As it is quite inconceivable that perfection in either material or workmanship will be ever secured, the nearest practical approach to it, consistent with requirements of the service demanded of the parts, is all that should be aimed at. This does not mean any deviation from the specifications that are intentional, no matter how much lee-way might be allowed for an accidental discrepancy. In the latter cases, a full and careful consideration should be given to the particulars of the fault or defect in relation to the effect it will have on the service of that piece, and when it is found obviously inconsequential, there should be no question of passing it; exactly as would be the case were the inspector paying for the vessel himself. It is a pertinent query to put to one's self in these cases, "Would I take it if I were buying it for myself."

If the consequences of using the parts are doubtful at all, the same directness should accompany its rejection, so as to permit the ordering another part at the earliest moment. There should be no doubts accompanying acceptance. If the matter is one of serious difference of opinion and the contractors desire to go beyond the inspector, it should be with his full written statement to the Bureau of his reasons for rejection, and fully shift the responsibility of overruling him to the Bureau, or whoever it is delegated to. Sometimes hardships are no doubt inflicted upon the contractor by rejecting what would be absolutely as good as a perfect part, but the moment laxity is shown in the matter of allowing "good enough" to equal excellent, when excellent has been stipulated, the efforts to produce excellent will be a little bit relaxed also, and a *precedent* in official action of this kind will have been established that will have a most persistent way of embarrassing future decisions.

Decisions should not be delayed a moment longer than it takes to get at the facts, or the positive existence of a reasonable doubt. It is money saved to the contractor to have decisions made promptly, one way or the other, and they justly appreciate a man who will not dilly-dally over a defect, nor take questions of acceptance home to think over and prepare a decision for next week. This must not be construed with advocating hasty or arbitrary action. If the inspector does not feel qualified to personally declare upon the fitness of a part, he should consult his assistants of more experience in the particular work, and if he does feel himself so qualified he should still consult his assistants so as to avoid overlooking some pertinent reasons for or against, which may may not have occurred to him. He should always have a reason and state it, but he should not argue over a fact.

All parts purchased from sub-contractors in a finished state, such as boilers, tubes, blowers, pumps, in machines, etc., and all castings and forgings made by sub-contractors for final machining by the contractor, are inspected by other officers detailed for outside material inspection, and in this degree the shipyard inspector is primarily assisted in a large field. He accepts these parts subject to final tests on board ship or to rejection for defects developed in machining.

As the inspector cannot personally be in the shops or on ship board more than an hour or two a day, he must have his representatives, special mechanics skilled in machine work, always

on the job. One at least should be in the shops and one on each large ship as soon as installation is begun, and the duty of these men is to keep the inspector daily posted as to defects, or of important work approaching in line of tests which he would prefer to witness himself.

In the larger items of shop work, and those in which accuracy and excellence of work and material directly affect the results of the trial trip, the contractor's interests are paramount, and there will be found little to criticize that will not be discovered and made good on the builder's own initiative. Clearances, journals and bearings, balancing of shafting and rotors, and of propellers, and making tight joints, all must be cared for in the best manner to bring about a satisfactory performance in engine operation and in water consumption.

The largest field for inquisitive inspection is that of castings, especially of iron or steel, and in this the inspector will find it necessary to remind himself of the guiding principle very often—"Only the *best* material and workmanship." In large iron castings, as of rotor casings or cylinders, there is need of assuring oneself of having the proper thickness of metal in the walls, with proper allowance for machining, and especially must the flanges measure fully up to the design after carefully noting the drop which the boring of a rotor casing will bring about, and upon which the final thickness of flanges will depend. Far better have them too thick than even a sixteenth thinner than called for. In parts of such importance and costs, there is no economy in allowing machining to proceed when positive indications are that the part will not measure up or will be a little short of dimensions when finished. Call it off at once, and if it appears to be within a fair margin of safety, refer the matter to the designing bureau immediately with exact figures, and do not assume any authority to accept short measure yourself, at least in flanges or in the steel castings for high pressure parts. It is usually under the test pressure that defects are found. One here must look closely for cracks and at once reject a cracked valve body no matter what metal it is made of. Sometimes a slightly porous condition will show up under the very severe hydraulic pressure put upon these bodies and yet not actually indicate a spongy spot in a bad sense. Slight caulking or peening will sometimes fully stop this acceptably, but spongy spots can be discovered by the peen hammer also, and an expert will readily show up the

difference. After machining, steam valves are tested under steam pressure, also to see if distortion from expansion prevents the valve from seating tightly, and in cases of the "double poppet" throttle valves of Destroyers, the greatest difficulty was experienced in this direction. It is interesting to study the designs of the larger steam valves and see the difficulties in the way of getting a "cold and hot tight" valve.

Electric welding may be allowed by the Bureau when the replacement is a serious expense or a cause of great delay to the vessel. This has been done with very satisfactory results in numberless cases abroad and at home, but in contract work it should not be permitted without a six months' guarantee after delivery of vessel.

The special mechanics must look closely after test numbers and inspector's stamps on material from outside sub-contractors, and should not permit removal of identification stamp until transferred to another part of the piece. Parts as finished should be weighed, stamped and recorded for final computation of weight sheets. Spare parts must be inspected, checked, boxed and boxes clearly marked with note of contents.

The witnessing and record of shaft calibration under torque must be carefully carried out, as the great value of the data is obvious in trial results.

Ship Inspection.—In installing machinery the general layout, as designed, generally will be followed very closely in the main elements, but in the case of the adjuncts and accessories thereto, much latitude is reserved and changes in location of auxiliaries or in run of piping are not only frequent but, for best results, must be made by personal observation of the compartments, and a practical sizing up of the several possible arrangements by temporary placements. The guide-word for this part of the work is *accessibility*—always *accessibility*. The inspector must be keenly alive to the fact that overhaul and repair work must often be done at sea, and in a hurry, and he must not permit a valve, pipe joint, cylinder, steam chest cover, or any other removable part to be located where its "undoing" will be the undoing of the worker. It is easy to prevent such faults in the original installation, but so difficult to correct them afterwards, that the writer most earnestly urges that the query be ever kept in mind "Are the removable parts readily accessible?" and then work to secure the very best arrangement it is possible to obtain.

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NAVY YARDS AS MANUFACTURING ESTABLISHMENTS, AND THE COST OF MANUFACTURED ARTICLES.

By Asst. Naval Constructor C. A. Harrington, U. S. Navy.

During the past few years the importance of navy yards as manufacturing plants has been brought home to some private concerns in the loss of contracts on account of the fact that a saving could be effected by manufacturing the article in certain yards at less cost than the same could be purchased. Careful scrutiny of cost returns to the bureaus, and investigation of the cost of manufacturing standard articles of equipage at the different yards has resulted in the designation of certain yards as manufacturing headquarters.

Every officer in the service knows, in a general way, that the New York yard has a capacity for manufacturing anything in the shipbuilding line from a rivet to a completed 26,000-ton ship. In addition, however, to being the designated navy yard for the manufacture of *Dreadnaughts,* the New York yard is also the manufacturing headquarters for a number of other articles of equipage. The following table, which shows the yards at which various standard articles are manufactured, may be of interest:

New York	Boston	Philadelphia	Norfolk	Portsmouth	Puget Sound	Mare Island
Ladder treads	Cot frames	Chests, inflammable liquids	Galley tubs	Clinical chart holders	Straps for hinged berths	Motor dories
Meat blocks	Motor dories	Mess tables and benches	Paint, torpedo boat, green	Invalid's food trays	Refrigerators	Paint, torpedo boat, green
Cutting tables	Straps for hinged berths	Machine cutting tools	Coaling bags	Spit cup holders	Chests for inflammable medical stores	Racing cutters
Racing cutters	Chains, ground	Refrigerators	Paint drums	Tumbler holders	Cleaning and painting stages	Boat cloths
Boat cloths	Chains, hang	Boat hooks	Signal-flag chests	Boat spars	Speed cones	Canvas cots
Coal trucks	Chain punches	Cleaning and painting stages	Paint, ship's bottom	Camp chairs	Ditty boxes	Covers, baize, for chronometer box

New York	Boston	Philadelphia	Norfolk	Portsmouth	Puget Sound	Mare Island
Coaling bags	Canvas cots	Chests for inflammable medical stores	Paint, for striping	Camp stools		Curtains, airport, door, etc.
Covers, baize, for chronometer box	Devil's claws	Wood fenders	Hammocks	Cooperage		Flags
Curtains, airport, door, etc.	Hammock bags	Anchor buoys	Ditty boxes	Franklin life buoys and spare parts		Table covers
Flags	Windsail bags		Scuttle butts for destroyers	Vegetable lockers		Signal-flag chests
Table covers	Bag bags			Squilgees		Vegetable lockers
Boat chests	Hawsers, rope, cordage			Squilgee handles		Mattresses
Mattresses	Hooks, chain			Spoon oars		Pillows
Pillows	Keying rings			Ditty boxes		Mattress covers
Mattress covers	Chain cables			Cargo nets		Pillow covers
Pillow covers	Pendants, clear hawse			Breaker stands		Angle hose valves
Racks for hand fire grenades	Shackles, cable, spare					Flanges for ventilation pipe
Coaling blocks	Shackle keys					Boat hooks
Speed cones	Shackle-pin tools					Boat chests
Ready mixed paints	Shackle-pin forelocks					Wood fenders
	Shackle-pin keys					Anchor buoys
	Skackle pins					
	Stoppers, bitt					
	Stoppers, deck					
	Stoppers, pelican hook					
	Stoppers, with turnbuckle					
	Stoppers, ring					
	Tents					
	Signal-flag Chests					
	Vegetable lockers					
	Voice-tube fittings					
	Hammocks					
	Fittings for hoisting steamers					
	Boat slings, chain					

It will be seen from this table that each of the industrial yards is charged with the economical manufacture of certain standard articles, and as these articles are produced in fairly large quantities, repeat orders being, of course, frequent, our navy yards to-day partake more of the nature of pure manufacturing establishments than ever in the past.

In order to keep track of the cost of manufacture of such standard articles, it is necessary to have such a system of manufacture that the shop superintendent or production manager may tell, as he goes through the shops on his frequent tours of inspection, just what progress is being made on any job, and what the direct labor cost is, so that, if necessary, steps may be taken to effect any possible economies.

Every job for the manufacture of standard articles is capable of being split up into a number of smaller jobs or operations. These smaller jobs or operations may be made many or few, depending upon the article that is to be manufactured and upon the discretion of the production manager. It is, therefore, possible to analyze each job and to make out for that job a set of standard operations as hereafter shown. These operations can and should be revised from time to time as new ideas are presented to the production manager, which will tend to reduce the cost of manufacture.

As a simple illustration take, for example, the manufacture of 100 food trays for sick-bay berths. These articles are described by specifications and consist of a brass pan about 14 inches x 22 inches x 1 inch deep, having four legs of such shape as to easily rest upon a sick-bay pipe berth, the tray being nickel-plated. The operations for the manufacture of 100 of these food trays are as follows:

SHEET METAL SHOP.

Operation No. 1.—Mark and cut out 100 pieces of sheet brass as per template for 100 food trays.
Operation No. 2.—Press out brass for 100 food trays.
Operation No. 3.—Anneal pans for 100 food trays.
Operation No. 4.—Trim and turn edges of 100 pans for food trays.
Operation No. 5.—Wire edges and smooth up edges of 100 pans for food trays.

Operation No. 6.—Solder corners of 100 pans for food trays.
Operation No. 7.—Cut out pieces of brass for legs of 100 food trays, 2 inches wide x 10 inches long.
Operation No. 8.—Hem edges and form up 400 pieces of brass for legs of 100 food trays.
Operation No. 9.—Press to shape 400 legs for food trays.
Operation No. 10.—Drill holes in pans and in legs for riveting 100 food trays.
Operation No. 11.—Rivet 400 legs on 100 food tray pans.
Operation No. 12.—Buff 100 food trays and prepare for nickel-plating.
Operation No. 13.—Nickel-plate and finish buffing 100 food trays.

From these detailed operations, it is seen that the manufacture of this article consists in marking out, pressing, wiring, buffing, riveting, and electroplating, each of these being separate and distinct jobs. The instructions for each operation are written on instruction cards and assigned to the various machines. When work is started on an operation, the time of starting is entered on the back of the instruction card and likewise, upon completion, the time of finishing is entered also. From these two entries, the time and the direct labor cost for the operation are easily obtainable, and this is the cost which the production manager must study and analyze if he desires to reduce the cost of production of the article. It should not be understood that the material and indirect costs are to be entirely ignored. Although material is generally fixed by specifications, at times other material, just as good as that specified, but of lower price, can be used to advantage for the desired purpose, and the production manager should also study the returned cost from this point of view. The indirect cost should, of course, be studied, but it is the hardest element of total cost for the production manager to control, inasmuch as a great many of the items which compose indirect expense are beyond his reach.

A divisional officer on board ship in training guns' crews selects his men, details them to the best advantage, that is, to the station for which they are best adapted, drills them and observes their motions, and introduces any little scheme whereby one second or a fifth of a second may be clipped off his loading time. In somewhat the same way, the production manager at a navy yard

studies the results obtained from the operation cards in the hope that hours may be clipped off future jobs of a similar nature. Frequently such study or analysis will show (1) that certain operations can be performed by lower priced men; (2) operations done by hand may be more profitably done by machinery, using dies, jigs, multiple patterns, etc., which makes it necessary to revise the standard operations; (3) competition may be introduced by assigning the same operations to different workmen, it being noted that, in this manner, a mechanic may be found who is especially adapted to the class of work under consideration. At this point, it is pertinent to note that, while there is no method in use at present at navy yards whereby a bonus or other reward may be received by navy yard workmen (there being also only a few yards where piece work is in use), the bonus system is practically in effect on board ship, in that prizes and higher rates of pay may be obtained by winning guns' crews and members of the engineer's force if the gun wins out at target practice, and the ship wins out in the engineering competition.

In the preceding paragraph, the methods of reducing costs have been outlined. The most important of these and the one which yields the largest returns is the substitution of machinery for hand labor, and the use of dies, patterns, templates, etc., wherever possible. As there are even at the present day some mechanics who have a grudge against labor-saving machinery, it is necessary for the shop superintendent (1) to have a knowledge of the capacity of the machinery at his disposal, and (2) to be thoroughly familiar with the method of manufacturing all standard articles, in order that slow and expensive methods may be replaced by economical ones. As an illustration of this, ditty boxes and camp chairs, camp stools, etc., which are given one coat of oil before shellac and varnish are applied, can be dipped in a small tank of oil by a laborer or helper in much quicker time than it takes the most expert painter to apply a coat of oil over the same article with a brush, and, in addition, the former method is believed to produce better results. It should be noted in these cases that, while the actual decrease in cost is effected by the use of labor-saving machinery, the necessity for the use of the same is brought to light by a study of the operation cards previously mentioned. A number of other cases where the cost of work has been reduced by the use of similar methods have also come within the experience of the writer.

The experience gained from these cases shows that, while the mere systematization of methods has a certain value of its own, and effects a saving in manufacture, the great gains are made by locating and remedying the leaks pointed out by the operation cards. It will be seen that this method bears a striking resemblance to the practice of making time studies on manufacture work.

A very important factor in connection with the unit cost of any article is the number of such articles that are manufactured in one lot. This principle applies in the manufacture of practically all articles. The unit cost of sailing launch masts, for instance, is less when these masts are manufactured in lots of ten than when they are manufactured singly. Likewise the unit cost of ditty boxes made up in lots of 100 is much more than the unit cost of boxes made up in lots of 1000. One reason for this, of course, is plainly evident in that the working gang have a better chance to warm up and do better team work on the larger lot than on the smaller. The principal reason, however, is determined from an analysis of the movements which make up an operation, and it may be here remarked that, in some systems of manufacturing, these movements are also known as operations, and are embodied in the written instruction sheet. The analysis of each operation shows that a certain amount of time is taken up in setting up a machine, which is the same for one article as for 1000. This is the principal reason why the unit cost of large lots is less than the unit cost on small lots, and can be seen from the following demonstration.

As the total direct labor cost is a function of time, it will suffice to show that the unit time on large lots is less than on small lots manufactured.

T_1 = total time for operation No. 1.
T_n = total time for nth operation.
t_1 = time required for putting the raw material through one complete cycle, *i. e.*, taking a sheet of brass, putting it through the press and putting the pressed pan in a second pile.
t_1^1 = time consumed in setting up the machine, which is the same for one article as for 500 or 1,000.
a = number of articles being manufactured.
T = total time for job.

Then $T = T_1 + T_2 + \ldots . T_n$.

$T_1 = at_1 + t_1^1$.

$T_n = at_n + t_n^1$.

$T = a(t_1 + t_2 + \ldots . t_n) + (t_1^1 + t_2^1 + \ldots . t_n^1)$.

Unit time of manufacture $= \frac{T}{a}$.

$$\frac{T}{a} = t_1 + t_2 + \ldots . t_n + \frac{(t_1^1 + t_2^1 + \ldots . t_n^1)}{a}.$$

It will be seen from this that as a is made large, $\frac{T}{a}$ may be to approach $t_1 + t_2 + \ldots . t_n$. On large orders $\frac{(t_1^1 + t_2^1 + \ldots . t_n^1)}{a}$ is very small and is practically negligible; on small orders and especially for articles which are composed of a number of machine operations, $\frac{(t_1^1 + t_2^1 + \ldots . t_n^1)}{a}$ is appreciable. This is the reason why manufacturing divisions at navy yards object to manufacturing articles in small quantities. Another important reason for turning out articles in large quantities (which, however, has no bearing on the cost, but which should be mentioned) is the large saving which can be made in clerical work in the offices of the General Storekeeper, manufacturing department, and accounting officer.

Some years ago there appeared in the NAVAL INSTITUTE a discussion of the wide variations in cost at navy yards of the same article when manufactured at different navy yards, and the article when manufactured at different times in the same yard. From the treatment of this question at present, it may be seen that the variation in unit costs is very likely to occur. Wide variation in costs should, however, be investigated. Invoiced prices are to be looked on with suspicion as they are frequently the result of an appraisal made from ignorance, an example of this being the appraised value of two life buoys which recently came within the writer's observation, namely, $90 each. The buoys in question needed repairs to the amount of $15 each to make them as serviceable as new buoys. If a re-survey and appraisal had not been made, these buoys would have been invoiced back to store at about $105 each, whereas the cost of new buoys is about $65 each. With manufacturing distributed to the various yards, as shown in the foregoing pages, the only permissible variation in cost should be

in the nature of reduction. As an example of the fairly constant price at which articles are now manufactured, may be mentioned the unit cost on three orders of ditty boxes completed at the Portsmouth yard during the past year, these orders being for 1500, 1000, and 800 boxes, on which the unit costs were $1.84, $1.732, and $1.737, respectively. The higher cost of the lot of 1500 over smaller lots is caused by a difference in material cost. Manufacturing conditions in navy yards are more standardized to-day than they were when the discussion referred to at the beginning of this paragraph appeared in these PROCEEDINGS.

In commercial life to-day competition is extremely keen, and manufacturing establishments take every chance to increase the volume of their business. Competition between navy yards is also more intense to-day than ever. The yard which can secure a large volume of varied manufacture work has a much better chance of preserving a constant working force. Men naturally do not work as efficiently if they know that discharges are to be made in the near future; hence, the importance of manufacture work to a yard which desires to maintain a fairly constant and efficient working force which will lead to a general high efficiency in the yard as a whole.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A HALF CENTURY OF NAVAL ADMINISTRATION IN AMERICA, 1861-1911.*

By CHARLES OSCAR PAULLIN.

I.

THE NAVY DEPARTMENT DURING THE CIVIL WAR, 1861-1865.

With the inauguration of Abraham Lincoln on March 4, 1861, there began at Washington a new administrative régime, destined to be long-lived, and to exercise a great influence upon the nation. New men, animated with fresh purposes and trained in a different political school from that of their predecessors, took up the work of Federal administration. The executive departments passed from the Democrats to the Republicans. With the exception of the Harrison-Tyler and Taylor-Fillmore administrations, the Democrats had been in power since the first inauguration of Andrew Jackson, on March 4, 1829. Disregarding Grover Cleveland's two administrations, the Republicans at the end of the administration of President Taft will have controlled the departments continuously since March 4, 1861—a period of fifty-two years.

On the coming of Lincoln, Southern influences, which for twenty years had predominated in the Navy Department, yielded to Northern. The Southern line of Secretaries of the Navy was succeeded by a new Northern line. The first Secretary under the Republicans was Gideon Welles, of Hartford, Connecticut. Welles served longer than any of his predecessors; and, up to the present time, than any of his successors. Two Secretaries, however, served almost as long—Robert Smith, 1801-1809, and George M. Robeson, 1869-1877. Welles's term extended from March 5, 1861, to March 3, 1869, and covered the administrations of

* Articles by the same author on the subject of Naval Administration in America have appeared in the PROCEEDINGS Nos. 119, 120, 122, and 124. This present series continues the subject.

Abraham Lincoln and Andrew Johnson. This period of eight years forms an important and well-defined era in naval history, since it is marked by the rise and decline of the navy of the Civil War. The first four years saw the rise, and the second four the decline of the navy. The former period, that of Welles's first administration, is practically coincident with the Civil War, and is treated of in this and the succeeding chapter.

The task of Secretary Welles from 1861 to 1865 was of greater magnitude and diversity than that of any of his predecessors. For four momentous years it was his lot to work and suffer with Lincoln under the heat, burden and turmoil of civil conflict. Many new duties unknown to the piping times of peace fell to him, and the old and usual duties of the naval office were greatly complicated, and were rendered important and insistent by the needs of war. The rusty machinery of the Department had to be repaired, lubricated, and enlarged. The thunderbolts of war had to be forged. Officers, sailors, and ships—the staples of navies—had to be supplied in great numbers. From 1861 to 1865 the number of ships increased from 90 to 670; of officers, from 1300 to 6700; and of seamen, from 7500 to 51,500. The annual naval expenditures rose from $12,000,000 to $123,000,000. With Welles rested the final decision respecting all shipbuilding programs, the principal plans of naval operations, and the general lines of naval policy. He was held responsible for the blunders and failures of the Department and the navy.

Gideon Welles was descended from the best stock of Connecticut. The original emigrant of his family to that state, Thomas Welles, held many important public offices between 1639 and 1659, being twice elected governor of the infant colony. Gideon was educated at the Episcopal Academy, in Cheshire, Connecticut, and at the Norwich University. He read law, and at the age of twenty-three became editor and one of the proprietors of the *Hartford Times,* which he edited until 1837. From 1827 to 1835 he was a member of the Connecticut legislature. For several years he served his state as comptroller of public accounts, and for some five years was postmaster of Hartford. From 1846 to 1849 he was chief of the Bureau of Provisions and Clothing in the Navy Department, at Washington.

In politics, Welles was for many years a Jacksonian Democrat. His anti-slavery views, however, carried him into the Republican

party, and in 1856 he was its candidate for Governor of Connecticut. He was a leading contributor to the *Hartford Evening Press,* the Republican organ of his state. For several years Welles was a member of the Republican National Committee. He was a delegate to the Republican National Conventions of 1856 and 1860, serving in the latter year as the chairman of the Connecticut delegation. During the presidential campaign of 1860 he labored earnestly for the election of Lincoln.[1]

In November, 1860, Lincoln began to consider various men for places in his cabinet. Welles's name was one of the first presented to him, and was the subject of a special consultation. Vice-President Hannibal Hamlin urged Welles's appointment. Senator John P. Hale, a New Hampshire politician of unsavory repute, was rather earnestly pressed upon the President for Secretary of the Navy, and he was somewhat mortified that his pretensions for the place were not more seriously regarded. Other names may have been considered. Lincoln, however, was from the first convinced of Welles's fitness, availability and representative character, and decided to invite him to a seat in the cabinet.[2]

The assignment of Welles to the Navy Department instead of to some other secretaryship may be ascribed to his three years' experience as chief of the Bureau of Provisions and Clothing, and to his residence in New England, whose maritime interests have given her a claim upon the naval portfolio. In making up his cabinet, Lincoln apportioned its members according to their sectional residence and their party antecedents. Welles was chosen as the New England member, and as a representative of the Democratic element of the Republican party. The early Republicans, it is recollected, were recruited principally from the Whigs, Democrats, and Free Soilers. The Whig faction was not generally friendly to Lincoln's naval secretary. Within the cabinet no love was lost between Welles and the Secretary of State, William H. Seward. In December, 1860, Thurlow Weed, one of the leaders of the Whigs in New York, spoke to Lincoln against his choice of Welles for the naval portfolio. Weed, so the story goes, said to the President that if he would, on his way to his inaugu-

[1] Boynton, Navy during the Great Rebellion, I, 22-24.

[2] Manuscript Papers of Gideon Welles in the possession of Mr. Edgar T. Welles of New York City; Nicolay and Hay, Lincoln, III, 367; Diary of Gideon Welles, vol. I, p. xxi.

ration in Washington, stop long enough in New York, Philadelphia, or Baltimore, to select an attractive figurehead from the prow of a ship, would adorn it with an elaborate wig and luxuriant whiskers, and would transfer it to the entrance of the Navy Department, this figurehead would be quite as serviceable to the navy as Welles, and much less expensive. "Oh," Mr. Lincoln replied, "wooden midshipmen answer very well in novels, but we must have a live Secretary of the Navy."[3]

Welles's "elaborate wig and luxuriant whiskers" gave him a patriarchical appearance, which his age and vigor of mind belied. When he entered the cabinet he was in his fifty-ninth year. Secretary of State Seward and Secretary of War Cameron were older than the Secretary of the Navy, and Attorney-General Bates was ten years his senior. Among the naval officers and sailors his paternal and benevolent aspect won for him the familiar appellation of "Father Welles," or "the Old Man of the Sea." Mr. Charles A. Dana, for a time an Assistant Secretary of War to Edwin M. Stanton, has left us one of the best characterizations of Lincoln's naval secretary. "Welles was a curious-looking man," Dana said, "he wore a wig which was parted in the middle, the hair falling down on each side; and it was from his peculiar appearance, I have always thought, that the idea that he was an old fogy originated. I remember Governor Andrew, of Massachusetts, coming into my office at the War Department one day, and asking where he could find 'that old Mormon deacon, the Secretary of the Navy.' In spite of his peculiarities, I think Mr. Welles was a very wise, strong man. There was nothing decorative about him; there was no noise in the street when he went along; but he understood his duty, and did it efficiently, continually, and unvaryingly. There was a good deal of opposition to him, for we had no navy when the war began, and he had to create one without much deliberation; but he was patient, laborious, and intelligent at his task."[4]

Welles was sometimes unjustly regarded as a time-serving, routine-loving secretary, a friend to red-tape. It is true that he was not one of those dashing administrators, who reach conclusions by intuition, put their decisions into effect with great

[3] Weed, Autobiography, I, 606-607, 611.
[4] Dana, Recollections, 170.

strenuosity, and are at once the inspiration and the terror of their subordinates. Rather, he was the quiet, unswerving, fearless executive, who reasons carefully from the evidence, and draws temperately his conclusions therefrom, who enforces his judgments with firmness and uniformity, and who gains the esteem of his fellows by reason of his patience, integrity, and justice. His qualities were solid, and never showy. While he had his antipathies, he nevertheless administered the navy as a rule with great impartiality. That he distributed the honors and rewards at his disposal without prejudice and bias, did not always appear to be true to those officers who were disappointed in not receiving their share of distinctions, and there are always many such officers during a war. Could they have known the mind of the Secretary of the Navy, they would have found that his decisions were based upon just principles of administration and the information presented to him.

Welles applied the laws of the navy fearlessly and without favor, no matter what the rank of the offender. He stood, as few Secretaries have, for naval discipline and an impartial administration of the naval code. More than once he rebuked a naval court for bringing in a verdict contrary to the evidence presented to it. A court-martial, of which Farragut was president, found the captain of a certain ship guilty of failing to do his utmost to overtake and capture a certain Confederate vessel, an offense punishable with death. The court sentenced the offending officer to be suspended from the navy for two years on leave-of-absence pay—a mere nominal penalty. Welles in reviewing these absurd findings pointed out that the sentence of the court would be too mild for a trivial offense, and declared that such punishment as the court had prescribed "no officer could obtain from the Department as a favor."[8]

Welles was generous in his praise of gallant and meritorious conduct. His congratulatory messages to the victorious naval officers were warm and hearty, and felicitously phrased. As a newspaper writer, he had acquired considerable facility in composition, and his official reports are therefore more interesting reading than most documents of this sort, usually so dry, commonplace and dispiriting. Unlike some of the Naval Secretaries, Welles did not depute to his subordinates the composition of his

[8] Official Records, ser. I, vol. 3, pp. 467-470.

annual reports, although he availed himself of their criticisms and suggestions. His writings reveal a faculty for lucid expression, clear thinking and the discernment of the gist of any subject. From the diary which he kept during and after the war, a recently published document of great historical value, one gathers that its author was methodical, painstaking and honest, and fearless in criticising his colleagues.*

In determining the policy of the government, Welles's advice was much valued by the President. His knowledge of public affairs was seasoned, and his judgment was sober and generally well balanced, but his counsel was not always politic. In the Mason and Slidell episode, he wrote a warmly congratulatory letter to Captain Wilkes, whose acts were finally disavowed by the President. That the Secretary of the Navy should have had a profound knowledge of international law was, however, hardly to be expected. Regarding the government's powers under the constitution, Welles took a middle ground, being neither a strict nor a broad constructionist. He and the Secretary of State were instinctively opposed to each other, and were usually on opposite sides of the questions that came before the cabinet. Welles regarded Seward as an intriguing and designing politician. He held, on plausible grounds, that Seward's conduct during the first weeks of Lincoln's administration was, if not traitorous, certainly highly unpatriotic. The Secretary of the Navy possessed none of those superb delusions that sometimes afflicted Lincoln's brilliant Secretary of State. On matters lying within the field of his information, his judgment was certainly as reliable as that of his colleague in the State Department.

Early in the war Welles and Seward did not get along well together, and some grave misunderstandings arose between them. At one time Welles and Secretary of War Stanton engaged in a serious altercation over the exchanging of prisoners. Several naval officers, notably Dupont, Wilkes, and Preble, had unpleasant differences with the Secretary. For all his controversies, it must be said, Welles had ample grounds. A fearless executive, intent upon the performance of his duties, is certain to have more or less trouble with his subordinates and colleagues. Some of Welles's critics, however, hold that his disputes reveal defects of character common to New Englanders—a lack of tact and sympathy, an

* See The Diary of Gideon Welles, 3 vols. (1911.)

arbitrary and inflexible mind, and an inability to understand an opponent's point of view.

To a technical and intimate knowledge of the navy, Welles made no pretensions. He, however, was better equipped for his duties than most Secretaries have been. His three years' service in one of the naval bureaus had given him a considerable acquaintance with the business of the Department. Fortunately, the limitations in Welles's naval knowledge were adequately compensated by the extensive professional information of his Assistant Secretary, Gustavus V. Fox, whose selection by President Lincoln as Welles's aid in the Navy Department was a most happy one.

At the beginning of the war Fox was in his fortieth year. He was born in Saugus, Essex County, Massachusetts. His father was a country physician, in moderate circumstances. At the age of sixteen young Fox was appointed midshipman in the navy, where he remained for eighteen years, and had a most varied naval career. He served in the Mediterranean, East Indian, Pacific, Brazil, and African squadrons, participated in the naval operations of the Mexican War, and for a time assisted in the work of the Coast Survey. In 1853-1854 he commanded a mail steamer, plying between New York and the Isthmus of Panama, and belonging to one of the subsidized steamship lines. In July, 1856, having reached the rank of lieutenant, he resigned from the navy and accepted the position of "agent" of the Bay State Woolen Mills, at Lawrence, Massachusetts. Early in 1861 he came to Washington with a plan for the relief of Fort Sumter, and in April President Lincoln permitted him to put it into operation. In planning, promoting and conducting this daring adventure, he displayed such energy, tact, and initiative, that the President was most favorably impressed with him. These qualities, together with the strong influence of his family connections, who stood close to Lincoln, soon brought him political preferment. On May 9, 1861, he was appointed chief clerk of the Navy Department, and on July 31 he was promoted to be Assistant Secretary of the Navy, a newly-created position.

Fox's career both in and out of the navy admirably fitted him for the assistant secretaryship. His long service in the navy gave him a wide acquaintance among the naval officers. He had acquired the habit of the navy and of the sea, and knew well the practice of the naval profession. On the other hand, his expe-

riences as a New England manufacturer had familiarized him with the currents of thought and action outside of the navy, with the methods of business, its economies and administration, and the qualities of commercial men. In the science of the naval profession, in contradistinction to its art, Fox was not especially well grounded. His knowledge of naval architecture was naturally limited, and his naval strategy proved to be at times faulty. He sometimes appeared more ready to plan, than laboriously to execute. Fox was decisive, quick of mind, and self-confident. No matter how dark and gloomy were the prospects of the Unionists, the buoyancy of his spirits never failed him. He was urbane and suave, and had a most engaging personality. The amenities of social life came easy to him. His father-in-law was Francis P. Blair, one of the leaders at the National Republican Convention of 1860; and his brother-in-law was Lincoln's postmaster-general, Montgomery Blair. During the war the Blairs were exceedingly influential in national politics. Few men, who in the eventful spring of 1861 came to the surface of that tempestuous political sea at Washington, were as likely as Gustavus V. Fox to survive in its rough waters and ride its waves to preferment and eminence.[7]

It is said that Fox was not Welles's first choice for the assistant secretaryship.[8] This may well have been, for the two men differed widely in professional training, habit of mind, and personal characteristics. Their official relations, however, were intimate, cordial, and unruffled by discords. Welles valued Fox's services highly, although he discovered certain shortcomings in him. Each gave to the other his confidence. As Assistant Secretary of the Navy, Fox was Welles's "chief of staff," his professional and confidential adviser. In choosing officers for important tasks, in formulating plans of naval operations, and in the execution of the technical business of the Secretary's office, Welles received the counsel and suggestions of his assistant, and largely acted upon them. In the work of the department, he gave Fox a remarkably free hand. Fox corresponded with many of the naval officers, sending them much valuable information, and often discussing with them their plans of naval operations. Notwithstanding these letters are personal, they assume a semi-official character by reason

[7] Nicolay and Hay, Lincoln, V, 4-5; Davis, Davis, 132-133.
[8] United Service, IV (1881), 36.

of the subjects discussed and the circumstances under which they were written. Respecting minor naval affairs, Fox gave official orders in his own name. Lincoln advised as freely with the Assistant Secretary as with the Secretary.

Both Welles and Fox had a great capacity for work, and each wrote with their own hands a vast number of letters. To their subordinates they often appeared fatigued and overworked. Night after night they toiled over their desks at the Department. In the course of his duties, Fox now and then visited the navy yards, or some of the principal seaports of the North. Infrequently, Welles and Fox went to the "front," the latter more often than the former. The Assistant Secretary of the Navy witnessed the fight at Hampton Roads between the *Monitor* and the *Merrimac*. In May, 1862, the Secretary of the Navy invited two or three members of the cabinet, the chief clerk of the Department, and several naval officers with the ladies of their families, to make a special cruise on the steamer *City of Baltimore*, and visit the Union fleets in the waters between Washington and Richmond. Such excursions must have brought to the Secretary and his Assistant a welcome relief from their arduous toil, and have given a brief diversion to their lives, so full of anxieties, vexations and discouragements.

It may be a little early, even yet, to apportion with nicety the respective shares of Welles and Fox in the management of the navy and the Department during the Civil War. It is plain that the Secretary of the Navy has not received sufficient credit for his services at the hands of historians. The brilliancy of Fox has somewhat obscured the deeper colors of Welles. To some writers it has appeared that the real power in the Department was the Assistant Secretary of the Navy, and that the Secretary was a sort of antiquated figurehead. While Admiral David D. Porter did not always write history with precision or impartiality, yet his estimate of Welles's services are worthy of consideration, coming as it does from a contemporary who was well situated for observation, fearless in the expression of his opinions, and not altogether friendly to the man about whom he was writing. In his naval history, Porter says that Gideon Welles was the responsible head of the Navy Department. "It was his judgment that decided almost all matters; it was his coolness and placidity of temper that controlled those around him and smoothed over the

little asperities and jealousies which would spring up among his subordinates—with a smooth word he brought back to his proper position any one who attempted to assume more than his rightful authority—in this way making a unit of the Department." Welles was the "judicial, financial, and political head, under whose directions everything was done; all plans were submitted to him, and no movement was made without his consent, and he weighed every matter before coming to a conclusion." According to Porter, Fox was the "able assistant," by virtue of whose aid the Secretary of the Navy accomplished his great work.[9]

The creation of the new post of Assistant Secretary of the Navy was earnestly desired by Welles. During the first months of the war his labors were so increased that the employment of an assistant was rendered imperative. Before the war the need of the Department for an official of this sort had been pointed out. In 1841 Lieutenant Matthew F. Maury had recommended the appointment of an "Under-Secretary" from the post-captains of the navy. Maury said that the Secretary "usually comes into office uninformed as to the condition of the navy, ignorant of its wants and usages, and unacquainted with the official character and standing of most of its officers. Accordingly he goes to work in the dark, and of course blunders and mismanagement ensue. It is a postulate granted by common sense, that a knowledge of details is as essential to the proper management of the navy as to the proper management of every other business, whether public or private." Maury wished, therefore, to attach to the Secretary's office a permanent official who should take charge of the detailing of officers, the shipping of seamen, and the equipment of vessels for sea. It may be said in passing that the duties Maury assigned to an Under-Secretary are at the present time performed in large part by the Bureau of Navigation and not by the Assistant Secretary of the Navy, who bears little resemblance to Maury's official.[10]

The first act authorizing the appointment of an Assistant Secretary of the Navy was passed on July 31, 1861. It did not enter into details. In the absence of the head of the Department, the new official was to act as Secretary of the Navy, and he was to

[9] Porter, Naval History of the Civil War, 360.

[10] Congressional Globe, 1861, p. 177; Southern Literary Messenger, VII, 24.

perform all such duties, in the office of the Secretary, "as shall be prescribed by the Secretary of the Navy, or as may be required by law." The salary attached to the new post was $4000 a year.[11]

During the first months of the war, the defects of the administrative system of the Navy Department were apparent. It was slow in adapting itself to the new conditions and in responding to the "executive touch." Indeed, early in the war the executive touch was not exercised with much confidence and precision. The weakness of the Secretary's office as a directing and unifying force was manifest. It was strengthened, as we have seen, by attaching to it an Assistant Secretary of the Navy. This may be regarded as a step towards unifying and correlating the work of the Department. The differentiating of the Department's functions, however, proceeded rapidly, and several new offices, bureaus and boards were created.[12]

One of the most important of the new departmental organizations was the "office of detail" which the Secretary of the Navy, on his own initiative, established as a part of the Secretary's office. Unfamiliar with the respective abilities and merits of the several naval officers, Welles, in March, 1861, ordered Commodore Silas H. Stringham to report to the Secretary's office for the purpose of assisting in the detailing of officers. On the breaking out of the war Stringham was detached, and his duties were vested in a navy board, or "office of detail." Commodore Hiram Paulding was placed at its head, and Commanders Charles H. Davis and Maxwell Woodhull were selected as its other members. Owing to Paulding's advanced age, the duties of chief of the office fell largely to Davis, who performed them until he was detached in the fall of 1861. In addition to the assignment of officers to duty, the office of detail had charge of the appointment and instruction of the volunteer officers. During the war it formed a part of the Secretary's office; but on April 28, 1865, it was placed in charge of the chief of the Bureau of Navigation.[13]

In his important reports of July 4 and December 2, 1861, Secretary Welles recommended, in general terms, a modification and

[11] U. S. Statutes at Large, XII, 282-283.

[12] Porter, Naval History of the Civil War, 20, 21; Church, Ericsson, II, 36; Davis, Davis, 146; Soley, Admiral Porter, 133.

[13] The Galaxy, X (1870), 624-626; Davis, Davis, 115-116, 121, 128, 133-134; Hamersly, List of Officers of the Navy, 1901, p. 4.

improvement of the organization of the Navy Department. He believed that the duties of the Department could be better distributed and classified. On January 24, 1862, Senator John Sherman, of Ohio, introduced in the Senate a bill providing for two new naval bureaus. In February there was substituted for Sherman's measure a "bill to reorganize the Navy Department of the United States," which provided for eight naval bureaus. One of these, among other duties, was to have the management of the Light House Service, but the friends of the Treasury Department prevented this innovation. The bill to reorganize the Navy Department became a law on July 5, 1862.[14] It established the following eight bureaus:

1. Bureau of Yards and Docks.
2. Bureau of Equipment and Recruiting.
3. Bureau of Navigation.
4. Bureau of Ordnance.
5. Bureau of Construction and Repair.
6. Bureau of Steam Engineering.
7. Bureau of Provisions and Clothing.
8. Bureau of Medicine and Surgery.

The act of July 5, 1862, which is still the basis of the organization of the Navy Department, increased the number of bureaus by three. The duties of the former Bureau of Equipment and Repairs were distributed among three new bureaus, Equipment and Recruiting, Construction and Repair, and Steam Engineering, and the duties of the former Bureau of Ordnance and Hydrography were divided between two new bureaus, Ordnance, and Navigation. Formerly, the chiefs of the several bureaus served during the pleasure of the President, but hereafter they were to be appointed for a term of four years. They were to receive $3500 a year, in lieu of all compensation as officers of the navy. The chiefs of the Bureaus of Yards and Docks, Equipment and Recruiting, Ordnance, and Navigation, were to be line officers, not below the grade of commander. The chiefs of the Bureaus of Construction and Repair, Steam Engineering, Medicine and Surgery, and Provisions and Clothing were to be, respectively, a

[14] Sen. Ex. Doc., 37 Cong., 1 sess., No. 1, 96; Ann. Rept. of Sec. of N., 1861, p. 22; Congressional Globe, 1861-1862, pp. 467, 761, 875-876, 1323, 1504, 2744-2745; U. S. Statutes at Large, XII, 510-512.

naval constructor, a chief engineer, a surgeon of the navy, and a naval paymaster, of not less than ten years' standing. The bureaus were to perform their duties "under the authority of the Secretary of the Navy, and their orders shall be considered as emanating from him, and shall have full force and effect as such"—a repetition of a provision of the act of August 31, 1842, instituting the bureau system. The new law provided for fifty clerks and draftsmen, which was a small increase in the clerical force of the Department. It further provided for an assistant chief in the Bureau of Ordnance, and a civil engineer in the Bureau of Yards and Docks.

The act of July 5, 1862, authorized the Secretary of the Navy to distribute the duties of the Department among the several bureaus as he should judge expedient and proper. The only important changes made in the distribution of duties were those necessitated by the establishment of the three additional bureaus. The duties of the Bureau of Equipment and Recruiting are sufficiently indicated by its name. The work of the Bureau of Steam Engineering related chiefly to the designing, construction and repairing of the steam machinery of ships. The Bureau of Navigation was made the scientific bureau of the Department. It owed its origin largely to Rear-Admiral Charles H. Davis, a progressive officer, who was much interested in promoting science within the navy. He was appropriately made its first permanent chief, entering upon his work in November, 1862, after the bureau had been organized by Captain James M. Gilliss. The Bureau of Navigation was given the supervision of the Naval Observatory and the Hydrographical Office, the Nautical Almanac Office, and the Naval Academy.

The chiefs of the naval bureaus during the Civil War were efficient and painstaking administrators, who were safe and conservative, rather than brilliant and aggressive. Several of them had been long in the service of the Department. Rear-Admiral Joseph Smith, the chief of the Bureau of Yards and Docks, entered the navy in 1809, and served with distinction in the War of 1812. He was chief of this bureau from 1846 to 1869. Paymaster Horatio Bridge, the life-long friend of Nathaniel Hawthorne, held the chiefship of the Bureau of Provisions and Clothing from 1854 to 1869. John Lenthall, of the Bureau of Construction and Repair, and William Whelan, of the Bureau of

Medicine and Surgery, each became head of his bureau in 1853, and served throughout the war. Lenthall did not retire from the chiefship until 1871. In 1865 Whelan was succeeded by his able assistant during the war, Surgeon P. J. Horwitz. Only a single bureau chief resigned to enter the Confederacy, Captain G. A. Magruder, of the Bureau of Ordnance. His successors were Captain A. A. Harwood, 1861-1862; Rear-Admiral John A. Dahlgren, 1862-1863; and Commander Henry A. Wise, 1863-1865. The work of these three chiefs was frequently commended for its promptness and efficiency. Dahlgren was the principal ordnance expert of the old navy, and during the war a close friend of President Lincoln. Davis, the first chief of the Bureau of Navigation, was succeeded in 1865 by Captain Thornton A. Jenkins. The first chief of the new Bureau of Equipment and Recruiting was an officer of the highest professional standing, Rear-Admiral Andrew H. Foote. During the war Davis and Foote rendered distinguished service on the Mississippi. The colonels-commandant of the marine corps were John Harris, 1861-1864, and Jacob Zeilin, 1864-1876.

The new Bureau of Steam Engineering was presided over from its organization in 1862 to 1869 by Engineer-in-Chief Benjamin F. Isherwood, a man of much originality, great independence of character and indefatigable industry. Unlike many of his colleagues, he was a comparatively young man. He was still living in 1912, the last survivor of the principal naval administrators of the Civil War. Before his appointment as chief of the new bureau, Isherwood was serving as engineer-in-chief of the Bureau of Construction, Equipment and Repairs. His work during the war, when a steam fleet was supplanting the old wooden one, was most exacting and important. It was sharply criticised, probably more so than that of any other chief of bureau. A recent writer seems to have completely vindicated Isherwood, who, he says, was the foremost man of the engineering corps in professional ability and zeal. Every demand made upon his bureau was promptly and efficiently met, and the standard of naval engineering during Isherwood's term of office was raised to an enviable height.[18]

At the very close of the war Congress created the office of naval judge-advocate general. Probably the first man to recommend the appointment of a permanent law officer, or officers, for the

[18] Bennett, Steam Navy, 202, 608-609.

navy was Secretary Crowninshield, in 1816. Many later secretaries made similar recommendations. On February 10, 1865, Secretary Welles wrote to the chairman of the House Naval Committee setting forth the need of the Department for a judge-advocate. He said that many "legal questions and suits growing out of the transactions of this Department are constantly arising. Some of them involve large pecuniary amounts, and frequently embrace great variety of detail. The cases of courts martial are numerous, and require scrutiny and careful preparation and revision. The forms and execution of contracts under the provisions of law demand deliberate and attentive care and consideration. Frauds and abuses on the part of contractors and employees call for investigation and prosecution, and the miscellaneous legal questions which arise are innumerable, involving often a vast extent and variety of detail." To take charge of these matters, and to advise the Department on them, a law officer was necessary. Welles enclosed the draft of a bill.[10]

Acting on the advice of the Secretary of the Navy, Congress, on March 2, 1865, authorized the appointment of a solicitor and naval judge-advocate general. He was to receive a yearly salary of $3500, and was to serve during the war and one year thereafter.[11] On March 6 President Lincoln appointed to the new post William E. Chandler, of New Hampshire, who many years later became Secretary of the Navy. On July 10, 1865, Chandler was succeeded by John A. Bolles, of Massachusetts, who served until 1870, when the office was discontinued and its duties transferred to the Department of Justice.

To assist him in his work, Welles created several temporary boards and agencies. The appointment of experts to advise and direct the Department or to perform some of its duties is a familiar device. By all odds the most important board instituted by Welles was the "Commission of Conference," the purpose of which was to determine the military and naval operations on the Atlantic and Gulf coasts, collect hydrographic, geographic, and topographic information, and to devise methods for rendering the blockade effective. It was especially to obtain such information as would be of value in capturing a naval base on the Atlantic coast of the Southern States. The notion of establishing this

[10] Congress Letters, II, 427; XIV, 236.
[11] U. S. Statutes at Large, XIII, 468.

commission originated with Professor Alexander Dallas Bache, the eminent superintendent of the United States Coast Survey. Its members were Professor Bache, Captain Samuel F. Dupont, and Commander Charles H. Davis, of the navy, and Major J. G. Barnard, of the engineer corps of the army. Dupont was its senior member, and Davis its secretary.

The Commission of Conference was organized in the latter part of June, 1861, and held its sessions at various times in July, August and September. It embodied the results of its labors in six reports, three relating to the Atlantic and three to the Gulf coast. Its views were developed by discussion, and were later written out by its secretary. The hydrographic and geographic information contained in its reports, which exceeded in amount that of a purely naval or military character, was chiefly derived from the records of the Coast Survey. The reports of the commission, which were discussed by the cabinet and by General Winfield Scott, of the army, proved to be valuable in formulating and executing the plans of naval operations. The commission was a confidential one, and its reports were not intentionally made public. Early in July, 1861, however, accounts of its deliberations began to be printed in the newspapers. It was impossible at this time to keep secret the work of the government, so successful were the friends and agents of the Confederates in obtaining information.[18]

In the spring of 1861 Welles instituted another confidential board. It was composed of the chiefs of the several bureaus of the Navy Department, and was charged with the duty of "considering and acting upon such subjects connected with the naval service as may be submitted to [them] by the Department for their opinion at this important juncture of our national affairs." It was further charged to make "such suggestions regarding the naval service generally as may occur to the board."[19] Commander C. H. Davis was its secretary.

In February, 1863, the Secretary of the Navy established the "Permanent Commission." Its original members were Davis, Bache and Joseph Henry, the secretary of the Smithsonian Institution. Its purpose was to report on all questions relating to

[18] Official Records, ser. I, vol. 12, 195-207; vol. 16, 618, 651, 680; Davis, Davis, 117-134; The Galaxy, XII (1871), 672.

[19] Davis, Davis, 117.

science and art upon which the Department wished advice, and it was authorized to call to its aid technical assistants. Many inventions, plans and devices, with which the government was flooded during the war, were referred to it for its opinion of their value. Until the end of the war it held frequent sessions, and transacted much business. The organization of this commission is of an additional interest, since it led to the founding of the National Academy of Sciences.[20]

Various other temporary boards, besides those above mentioned, were appointed by the Department during the war. There were, for instance, an "iron-clad board," a "harbor commission," a "board on steam expansion," a "board on plans and designs for new vessels," and a "board on parole of prisoners." The work and organization of the iron-clad board will be considered in another connection.

Since the construction and engineering bureaus in Washington were unfavorable to the building of vessels of the "monitor," or double-turretted iron-clad type, a sort of monitor bureau was created at New York. Rear-Admiral F. H. Gregory was placed at its head, and directly under him was Chief Engineer A. C. Stimers. This office had charge of the construction of all ships and engines of the navy, and especially of monitors and iron-clads built by private contract. Its staff of assistants, draftsmen and clerks was almost as large as the similar force of the Navy Department in Washington. It was sometimes called the "draftsmen's paradise," on account of the large number of employees of this class, and the large wages paid them, twenty dollars a day. Under Gregory were some forty-five or fifty naval officers, who were stationed at the various ports where the navy had work which was being performed under contract. "The New York section of the Navy Department" ran its affairs with a rather high hand. It was especially partial to the construction of monitors.[21]

Several agencies were established for the transaction of special duties. One of great importance was that of Mr. George D. Morgan for the purchase of vessels. The superintendence of the construction of certain light-draft monitors was intrusted to Chief Engineer A. C. Stimers. In March, 1863, Messrs. John M. Forbes

[20] Davis, Davis, 285-286, 289-290; Bureau Letters, IV, 153.
[21] Bennett, Steam Navy, 485; Buell, Charles H. Cramp, 79.

and Wm. H. Aspinwall were sent to England to prevent the sailing of the iron-clads that were being built there for the Confederates, but their mission was unsuccessful. At the outbreak of the war, most of the navy agents of the Department in foreign countries were discontinued, as there was little need of them, since from 1861 to 1865 but few vessels were maintained abroad. At London, however, the Baring Brothers continued to act as the financial agents of the Department. Navy storekeepers were employed at Spezzia and Panama.

The chief clerk of the Navy Department was an important official during the war. He had charge of the records, correspondence and personnel of the Secretary's office, and the finances of the Department. Charles W. Welsh, Toucey's chief clerk, was succeeded by Hobart Berrian on March 14, 1861; Berrian, by Gustavus V. Fox, on May 9; and Fox, by William Faxon, on July 31, who held the position until June 1, 1866. Faxon, like Welles, was a resident of Hartford, Connecticut. For many years he had been a friend of Welles, and had been associated with him in the work of the *Hartford Evening Press*. Faxon entered the Department on March 19, as a clerk of the second class in the Secretary's office. His fitness for this position was determined by a board of examiners appointed by the Secretary of the Navy—an early application of the principles of civil service to the Navy Department. Welles, Fox and Faxon were the New England trio that presided over the Department during the darkest period of its existence.

During the war the clerical work of the Department was considerably increased, though by no means to the extent one might suppose. The number of regular clerks and draftsmen employed in the Department at Washington in 1860 was 39, and in 1865, 66. The office hours, which were regularly from 9 a. m. to 3 p. m., were, for many clerks, greatly lengthened, and often extended into the night. On certain afternoons, however, some of the employees were dismissed at 2 o'clock, to engage in military drills and exercises. But few of them welcomed this relief from their desks, since they generally preferred their writing and accounting to the hauling about of brass howitzers in the hot sunshine. At the beginning of the war all the clerks were required to take an oath to support the constitution. In March and April, 1861, most of the clerks who sympathized with the Confederacy, about one-

fourth of the clerical force, resigned; and some of them found positions in the Confederate Navy Department. There remained in the Department throughout the war several employees who were unfriendly to the North, and who, in the opinion of the Unionist clerks, were at heart disloyal. In July, 1861, President Lincoln removed the Democratic navy agents in the several Northern ports, and appointed Republicans in their places. Welles was disinclined to remove any employees for political reasons or "offensive partisanship," and much clamor was raised against him for his forbearance. His stand was in striking contrast to that of some of his colleagues in the cabinet, who discharged the Democrats from their department by the wholesale. In order that the policy and action of the government should be uniform, Lincoln requested the Secretary of the Navy to remove a few Democrats from the Navy Department.

To meet the demands of the bureaus for additional quarters, a new wing and a third story were added to the old Navy Department building. It was situated a stone's throw to the westward of the White House. The rooms of Welles, Fox and Faxon were on the second floor, in easy reach of each other. Here throughout the war President Lincoln often called and chatted in the most informal manner, and his gaunt form became a familiar figure to the employees of the Department. A clerk, who is still living, remembers seeing him appear in one of the bureaus wearing "carpet slippers." Occasionally he wore a shawl over his shoulders—a common article of dress for men at this time. It was in the Bureau of Ordnance, while watching a German regiment pass the window, that Lincoln propounded the conundrum, "Why is an Amsterdam Dutchman like any other damn Dutchman?" The diary of Rear-Admiral John A. Dahlgren abounds with references to Lincoln's visits to the Department, and to the Washington navy yard. The following characteristic entry for March 29, 1863, may be quoted: "I went to the Department. Found the President in the Chief Clerk's room with the Secretary and Fox. He looks thin and badly, and is very nervous. Complained of everything. They were doing nothing at Vicksburg and Charleston. Dupont was asking for one iron-clad after another, as fast as they were built. He said that the canal at Vicksburg was of no account, and wondered that a sensible man would do it. I tried my hand at consolation, without much avail.

He thought the favorable state of public expectation would pass away before anything was done. Then levelled a couple of jokes at the doings at Vicksburg and Charleston. Poor gentleman!"[22]

The details of the naval business were of course generally managed by the Navy Department. The President, however, kept in close touch with the navy. As a rule, the orders of the officers were issued by the Secretary of the Navy. But infrequently, when the need of action was very great, they were written by the President himself. Whenever the chief commanders were in Washington they always called upon Lincoln, and found him an eager listener to all they had to tell about their plans and operations. Farragut, Porter, Dahlgren, Dupont, Davis, Foote, and other leading naval men were often in conference at the White House. In the selection of officers for important commands, Lincoln generally followed the advice of the Department. Porter said that Lincoln seemed to be familiar with the name, character, and reputation of every officer of rank in the army and navy, and "appeared to understand them better than some whose business it was to do so."[23]

When Welles entered upon his duties on March 7, 1861, he found the Department and the navy in a deplorable condition. Many of the clerks were hostile to him. The disaffected officers of the Department maintained a rallying-point in the Bureau of Ordnance, whose chief, Captain George A. Magruder, and whose clerks, almost to a man, later allied themselves with the Confederacy. The Naval Observatory, under the command of Commander Matthew F. Maury, a warm friend of the South, was another center for the propagation of secessionist doctrines. The officers of the navy were more or less demoralized. Already several of them had resigned, and many others were suspected of disaffection to the Union. Captain Samuel Barron, one of the leaders of the clique of Southern officers favorable to the interests of the Confederacy, was exercising a considerable influence on naval affairs. It was impossible for the Secretary of the Navy to tell his friends from his foes. The Pensacola navy yard was in the hands of the Confederates. The situation at the Norfolk yard was by no means assuring. Among the officers of the Washington yard sentiments of disloyalty were common. All of the navy

[22] Dahlgren, Dahlgren, 390.

[23] Porter, Incidents and Anecdotes of the Civil War, 283.

yards were in bad repair, since no appropriations for their improvement had been made for several years. The national treasury was bankrupt. In pursuance of President Buchanan's policy, Secretary Toucey had failed to place the navy in a posture of defense. As was customary in peace, most of the vessels were on foreign stations. The home squadron in commission consisted of 12 vessels, carrying 187 guns and about 2000 men.

It was under these circumstances that Welles took charge of the Navy Department. A sharp turn in its policy might have been expected to signalize the advent of a Republican administration and Secretary of the Navy, but no sudden change of any sort took place. For the first three weeks Welles did almost nothing to increase or improve the naval defense of the country, and for the second three weeks he did but little. In the first days of April he prepared an expedition for the relief of Fort Sumter, and opened rendezvous for the enlistment of seamen at several Northern ports. Until the firing on Fort Sumter, the policy of Lincoln differed only slightly from that of Buchanan. It was one of conciliation and temporization; it was passive, hesitant, expectant, uncertain, cautious, and tentative. Lincoln and the members of his cabinet were not familiar with Federal administration, nor with each other, and at first they did not pull well together. They were strangely awkward at their new work, how awkward it is painful to tell. The attempts of the Secretary of State to manage the government and the President are well known.

Seward's interference with the affairs of the Navy Department greatly added to the confusion of the first weeks of the new administration. On April 1, without consulting the Secretary of the Navy, he obtained the signature of President Lincoln to a most remarkable naval document. It was addressed to Welles, and was in the handwriting of Captain Montgomery C. Meigs, of the army—with the exception of the postscript, which was written by Lieutenant David D. Porter, of the navy. The document was an order of Lincoln to Welles to make certain details of naval officers and certain changes in the organization of the Navy Department. Of special significance was the direction to Welles to detach Commodore Silas H. Stringham from the Secretary's office, to order him to Pensacola, and to supersede him as detailing officer with Captain Samuel Barron. The postscript,

which related to the organization of the Department, read as follows:

As it is very necessary at this time to have a perfect knowledge of the personal of the navy, and to be able to detail such officers for special purposes as the exigencies of the service may require, I request that you will instruct Captain Barron to proceed and organize the Bureau of Detail in the manner best adapted to meet the wants of the navy, taking cognizance of the discipline of the navy generally, detailing all officers for duty, taking charge of the recruiting of seamen, supervising charges made against officers, and all matters relating to duties which must be understood by a sea officer. You will please afford Captain Barron any facility for accomplishing this duty, transferring to his department the clerical force heretofore used for the purposes specified. It is to be understood that this officer will act by authority of the Secretary of the Navy, who will exercise such supervision as he may deem necessary.[24]

These orders went far towards superseding Welles as Secretary of the Navy by Barron. In the management of the Department, they made the naval officer the more important official. Upon receiving them, Welles was greatly astonished, and he immediately, on the night of April 1, carried them to the White House for an explanation. Lincoln was much surprised to find that he had signed a document of such import. He said that Seward, with two or three young men, had been at the White House during the day on a matter which the Secretary of State had much at heart; and that he had signed the document without reading it, or knowing what it was, supposing that it related to an enterprise of Seward. Welles told Lincoln that he had no confidence in the fidelity of Barron, who was by the order forced into an official and personal intimacy with him, and was virtually given charge of the Department, that the establishment of a bureau by an executive order was unlawful, and that the proposition to make a naval officer Secretary *de facto* was illegal, and in his view "monstrous." The President replied that he knew nothing of Barron, that the document was not his, although he had signed it, and that Welles should treat it as cancelled. He expressed regret that he had blundered, and was wont afterwards to say that during the first weeks of his administration he and the members of his cabinet were all new to their work, and naturally made mistakes. Welles believed that the attempt of Seward and Porter to place the principal business of the Department in the hands of Barron

[24] The Galaxy, X (1870), 624.

was a movement in behalf of the Confederacy and the Southern naval officers. Barron was shortly dismissed from the naval service. He entered the Confederate navy, taking rank as captain, from March 26, 1861, five days before the date of the executive order giving him charge of the Federal Navy Department.[25]

Seward's interference with the Department was not confined to measures for its reorganization and to the detailing of naval officers. He planned a naval expedition for the relief of Fort Pickens, Florida, which was officered and fitted out, and had sailed before the Secretary of the Navy got wind of it. This was the enterprise to which Lincoln supposed the above-mentioned document related when he signed it. On April 1 Seward had obtained Lincoln's signature to a second document. This ordered Lieutenant David D. Porter to proceed to the New York navy yard and prepare an expedition for the relief of Fort Pickens. At this very time Welles was fitting out at the New York yard an expedition for the relief of Fort Sumter, which was to be under the command of Gustavus V. Fox. Both Welles and Seward intended that the *Powhatan* should sail as one of the ships of their respective fleets. It therefore happened that the orders which Seward had obtained from the President and those of Welles respecting this vessel conflicted. The commandant of the New York yard was naturally confused. Since the President's orders were superior to those of the Secretary of the Navy, he gave Porter possession of the vessel. Welles was completely in the dark as to Porter's movements, until about the time that Porter's fleet sailed from New York for Fort Pickens on April 6. On receiving intelligence of them he, in company with Seward, went to the White House and asked an explanation of the diverting of the *Powhatan* from the Fort Sumter expedition, which, he said, would fail for lack of this ship. Lincoln yielded to Welles, and decided that Porter should turn the vessel over to Fox. An order to this effect signed by Seward was sent to Porter, but he had already sailed. A tug was procured, and the orders reached him before he got to sea. He declined to detach the *Powhatan* from his fleet, on the ground that he was acting under orders signed by the President, while the countermanding orders were signed by the President's subordinate, the Secretary of State. The *Powhatan,* therefore, proceeded to Fort Pickens.

[25] The Galaxy, X (1870), 624-626.

Welles and Fox always maintained that the sending of Porter's expedition was one of the main causes of the failure of Fox's.[26]

Porter cannot be freed from all blame for the part that he played in these strange proceedings. He was a man of mature years and long naval experience. The postscript of one of the aforementioned documents was in his handwriting. Knowing well the routine of the Department, he must have been aware of the irregularity of Seward's acts. He must have foreseen that they would likely cause confusion. One might suppose that he had some knowledge of the character of Barron, and of that officer's unfitness for the management of the navy during the crisis of the spring of 1861. On the other hand, it may be said in behalf of Porter, that he was acting in accordance with the orders of his superiors, the President and the Secretary of State; and that, under the extraordinary circumstances that then existed, irregularities were to be expected.[27] When he accepted the command of the Fort Pickens expedition, he was under orders to proceed to the West Coast and report for duty on the Coast Survey, a detail which he had sought. Welles did not forget the part that Porter played in Seward's machinations. That he did not permit it to prevent the advancement of that gallant and meritorious officer, is a tribute to his fairness.

Looking in retrospect, one can now see that during the first weeks of Welles's administration no matter deserved more consideration than the holding and defending of the Norfolk navy yard. It was one of the three principal navy yards in the United States, and contained numerous dwellings, sheds, storehouses and machine shops, large quantities of tools, machines, naval stores and provisions, and some two thousand pieces of artillery. Connected with the yard was a commodious dry dock of granite, and near it were twelve ships. One of these, the *Merrimac,* when equipped for sea, was worth $1,200,000. The total value of all this property was estimated by the Department at $9,760,000. The Norfolk yard was strategically situated for the use of either the Unionists or Confederates. To the latter, at the beginning of the war, its ordnance stores were worth far more than their value in money. These facts did not receive the consideration by the

[26] The Galaxy, X (1870), 627-637; XI (1871), 105-107; Official Records, ser. I, vol. 4, 228-241; Diary of Gideon Welles, I, 16-26.

[27] Soley, Admiral Porter, 101-102.

Secretary of the Navy and the President that they deserved. It is not here urged that they should have provided for the defense of this yard independent of the general policy of the administration. But certainly they should not have formulated their general policy independent of its effect upon the holding of the yard.

During the first weeks of his administration Lincoln's policy was to do nothing that might offend those Southern States that still remained in the Union. He was especially considerate of the feelings of the Virginians. While some slight measures for the defense of the Norfolk yard were taken late in March and early in April, 1861, not until about the time that the Old Dominion seceded from the Union were any vigor and decision respecting this establishment shown by the administration. On April 16, Welles ordered Commodore Hiram Paulding to proceed from Washington to Norfolk, and to consult with the commandant of the yard, Captain C. S. McCauley, about its defense and the protection of its ships. Paulding carried an order to McCauley that rang with true mettle, the first issued by the Department for several months, of which this may be said: "The vessels and stores under your charge," the order read, "you will defend at any hazard, repelling by force, if necessary, any and all attempts to seize them, whether by mob violence, authorized effort, or any assumed authority." During the next four days the Department showed considerable activity. Unfortunately its efforts were too late. McCauley and Paulding, who were in positions of authority, did not rise to the occasion. They were too old, too long schooled in routine, to accomplish great things in a sudden emergency. McCauley lacked energy and initiative, and he was largely under the influence of his disaffected officers, who were Southerners, and who did their utmost to deceive him as to the real situation of the yard. On April 20, fearing an attack on the ships, he ordered them to be scuttled. They were sinking when Paulding arrived from Washington with new orders. The two officers now decided not to attempt a defense, but to destroy all the public property, and to abandon the navy yard. Their work of destruction was hasty and ill executed, and much property fell into the hands of the Confederates.

Possession of the Norfolk navy yard with its valuable supplies was of great service to the South. Its cannon were used in fortifying the forts and batteries of the Confederacy on the Atlantic

and Gulf coasts, and the Potomac, York, James, Rappahannock, and Mississippi rivers. The *Merrimac* was raised and converted into a terrible engine of war. Its dramatic contest with the *Monitor* made its name famous. The granite dry dock was little injured. Many of the workshops, with their valuable machinery, escaped harm. Admiral Porter said that, "but for the misfortune of losing, or we may say throwing away, the Norfolk navy yard, all the unarmed ports of the South would have easily fallen into our hands." The evacuation of Norfolk and the Norfolk navy yard was one of the greatest blunders of the war.[28]

The naval war with the Confederacy properly began on April 19, 1861, with the issuing by President Lincoln of a proclamation of the blockade of the coast of the Southern States from South Carolina to Texas. From this time the Department prosecuted its work with much industry and with considerable vigor. On July 4, when the members of the Thirty-seventh Congress met in special session, Welles was able to make a very creditable showing of his activities and achievements. Shortly after April 19, the commandants of the Boston, New York, and Philadelphia navy yards were authorized to equip all the public armed vessels that they could purchase or charter, and a flotilla, with its rendezvous at the Washington navy yard, was fitted out for the defense of the nation's capital and the Potomac River. On April 30 the commandants of the navy yards and the naval rendezvous were authorized to enlist seamen to serve for one year. In the latter part of April seven vessels were chartered. By July 4, 82 vessels, carrying upwards of 1100 guns, and manned by about 13,000 men, exclusive of marines and officers, were in commission. The East Indian, Mediterranean, Brazil, and African squadrons, with the exception of one ship in each of the two latter squadrons, had been recalled. The Department had contracted for 23 gunboats, of about 500 tons burden each, and had made preliminary arrangements for the construction of several larger and fleeter ships. It was also expediting the construction of eight sloops of war at the Northern navy yards.

On April 27 the President issued a proclamation extending the

[28] The Galaxy, X (1870), 112-119; Sen. Rept. 37 Cong. 2 sess., No. 37, 1-123; Official Records, ser. I, vol. 4, pp. 272-313; Sands, From Reefer to Rear-Admiral, 225-229; Porter, Naval History of the Civil War, 62; Parker, Recollections of a Naval Officer, 206-207; Diary of Gideon Welles, I, 41-53.

blockade so as to include the ports of North Carolina and Virginia. On April 30 foreigners were notified of the effective blockade of Hampton Roads, Virginia. The blockading vessels along the extensive seaboard of the Southern States were placed under two commands. Flag-Officer Silas H. Stringham was given the command of the squadron on the Atlantic coast; and Flag-Officer William Mervine, that on the Gulf coast. Stringham arrived at Hampton Roads with his flagship *Minnesota*, on May 13, and Mervine reached the Gulf on June 8. Previous to the arrival of the latter, the mouth of the Mississippi River and several Gulf ports had been blockaded. By July 4, Stringham's squadron consisted of 22 vessels, 296 guns, and 3300 men; and Mervine's of 21 vessels, 282 guns, and 3500 men. Colliers had been purchased, and were transporting coal to the two squadrons.[29]

The first notable service of the navy in the war was performed by the Potomac flotilla in April and May, 1861, in defending Washington, and in keeping open the Potomac for the passage of transports and supply ships. The Confederates tried to get possession of this river, fortify its banks and cut off communication between Washington and the Chesapeake. The first naval officer that was killed in the war, Commander J. H. Ward, lost his life while in command of this flotilla. The history of the Potomac flotilla and that of the Washington navy yard are inseparable. Before the military forts and batteries were erected on the heights surrounding Washington, the navy yard, situated within the city on the Eastern branch of the Potomac, was the principal defense of the capital. On or about April 22 almost every officer in this yard, including its commandant, Captain Franklin Buchanan, resigned their commissions in the navy. On this day Commander John A. Dahlgren, who was in charge of the department of ordnance of the yard, was ordered to succeed Buchanan, and during the next few months he performed with great industry and efficiency the arduous work that devolved upon him.

During the latter part of April, and the whole month of May, 1861, when it seemed that Washington would certainly fall into the hands of the Confederates before an effective force of troops from the North could reach the city, the President often visited the Washington navy yard and consulted with Dahlgren, for whom he had a high regard. The excitement, gloom, anxiety and

[29] Sen. Ex. Doc., 37 Cong. 1 sess., No. 1, 85-98.

alarm of those memorable days were never forgotten by the residents of the capital. For some time after the arrival of the first troops, the situation was little improved in the minds of the terror-stricken inhabitants, as may be seen from the words of Commander C. H. Davis, written on May 25, at his desk in the Navy Department to his wife: "We have had an exciting time this morning. Poor Ellsworth's funeral; an attack on the New Jersey regiment at the Chain Bridge by the Virginians; and the report of a fight at Sewall's Point. The alarm guns were fired for the first time, and war has actually begun. The Navy Department is well prepared with rifles and revolvers. The bells are now ringing, and it would seem that the alarm continued. The Commodore, Woodhull, and the clerk are loading the muskets (rifles) in the room where I am now writing."[20]

Directly after the battle of Bull Run, the fear, excitement and consternation in Washington was more intense than they had been during the first days of the war. A letter of Davis, written on July 23, shows the effect of the defeat upon the personnel of the Department: "Yesterday was a day of the deepest gloom. It was a day that recalled the scenes of history and historical painting, in novels and in the drama. Great excitement prevailed. Notwithstanding the rain, people stood about in groups and talked mysteriously, or listened to some straggler from the other side. Many countenances wore expression of alarm, all of anxiety. It was a long time before the clerks could get to work; they sat in listless apathy. Woodhull, who was among the most excited, burst out, while I was sitting at the desk writing, into expression of astonishment at what he called my coolness; though, as there was no danger immediately threatening us, there was no occasion for the exhibition of coolness. He was running around in the pouring rain as if set in motion by springs, and unable to keep still. Such was the alarm that the storm which hung the heavens in black was hailed with delight as an impediment to the march of the rebels, who, it was feared, would follow up their retreating foes and invade the capital. I shared of course in the alarm and depression; but after I had made up my mind to put on my uniform and go into the intrenchments in the event of an attack, I felt better, wrote all the morning and two hours in the evening."[21]

[20] Davis, Davis, 143-146.
[21] Davis, Davis, 151-152.

(TO BE CONTINUED.)

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE LAUNCHING OF THE *NEW YORK*.

By NAVAL CONSTRUCTOR ROBERT STOCKER, U. S. Navy,

AND

NAVAL CONSTRUCTOR HENRY WILLIAMS, U. S. Navy.

> And see! She stirs!
> She starts—she moves—she seems to feel
> The thrill of life along her keel,
> And spurning with her foot the ground,
> With one exulting, joyous bound,
> She leaps into the ocean's arms!
>
> —*Longfellow.*

The problem of launching a big ship presents many difficulties and complications. There are numerous chances for error, any one of which might prove fatal to the success of the launching, or indeed result in total loss of the vessel. A man-of-war usually is more difficult to launch than a merchant vessel of equal or even greater displacement, as the weights are concentrated over a shorter length, it is of greater beam and often though the structure is more complicated, its local strength and ability to withstand the concentrated loads incident to launching are less.

Another feature that renders difficult the launching of a large vessel is the human element that enters into the preparation and the actual operation. So many men are engaged on the work that the chance of error is correspondingly increased. Then, too, launchings, particularly in navy yards, are infrequent, and the personnel must be trained especially in each case, with a resulting less degree of efficiency than can be obtained in operations commonly carried out.

The launching of the *New York* was achieved successfully at the hour set, without any unfavorable incident, or undue difficulty in carrying out the program.

The static forces that act on a ship during launching are indicated in the diagram below. The motion of the ship along the launching ways is due to the component of the force of gravity:

$$G \sin \theta.$$

This movement is resisted by friction which is:

$$fG \cos \theta,$$

f being the coefficient of friction. In order that the vessel will move the condition represented by the following equation obviously must obtain:

$$G \sin \theta > fG \cos \theta,$$

or

$$f < \tan \theta.$$

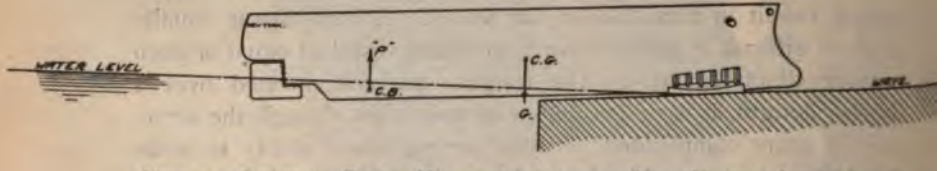

DIAGRAM SHOWING STATIC FORCES ACTING ON A SHIP DURING LAUNCHING.

The values of the coefficient of friction that may be expected under the usual conditions of launching are well known, having been determined carefully from data taken at previous launchings and experimentally in connection therewith. Thus the minimum admissible value of the angle of inclination of the launching ways is determined. It is customary to adopt an angle that will ensure the vessel sliding off, that will not give too great speed, and that is permitted by the conditions of construction of the vessel, the possibility of holding the ship and the depth of water available where the vessel is to be launched.

As the vessel slides down the ways and enters the water, the buoyancy of the submerged portion of the hull acts with an increasing force through its center of buoyancy which changes progressively in location. The force of gravity due to the weight of the vessel acts with a uniform force through its center of gravity, which is fixed. The launching ways, therefore, support a load continually lessening as the ship advances, and the resultant of the forces of reaction exerted by them changes correspondingly in amount and point of application. When the point of application of this resultant of the forces of reaction reaches the forward or shore end of the sliding ways, the stern of the vessel lifts and the ship "pivots" around the forward end of the ways or "fore-poppets." From this point the vessel is partly afloat, and it advances down the ways until either the end of the ways is reached and the ship drops off, or the ship becomes entirely waterborne.

If the center of reaction of the ways passes off the extreme end of the ground ways before pivoting takes place, the vessel will "tip," that is, the forward end will rise from the ways and the stern will drop. This condition must be avoided, as it will result generally in serious damage to the vessel through concentrating the support at a point where the structure is not able to stand it, or in straining the ship and "breaking its back." In order that these conditions may be understood and accidents guarded against, it becomes necessary before even the ship is laid down to make certain launching calculations. At first these are approximate and serve only as a guide to determine the inclination and limiting dimensions of the launching ways and the maximum possible weight of the hull that is to be launched. Later these calculations are made accurately and a diagram drawn which shows the conditions as they will exist actually.

The weight of the hull is determined from the weight records and from a consideration of the percentage of completion of the various groups as estimated in the original design calculations. This latter gives also the center of gravity of the structure as launched. As an indication of the accuracy obtained, the mean draft of the *New York* after launching was found to agree within less than one-half inch with the calculated mean draft. Displacements and centers of buoyancy are calculated for water-lines inclined to the angle of the launching ways, and from these the moments of the force of buoyancy around the fore-poppets are

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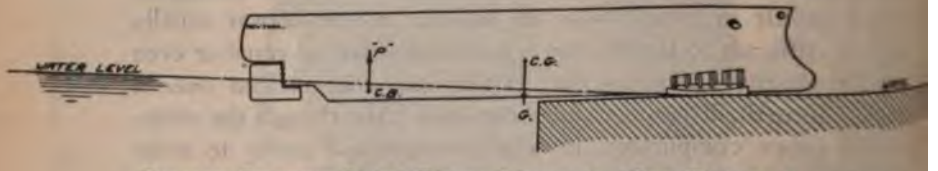

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CURVES OF LAUNCHING DATA AND C

: Various Forces and Moments Acting

calculated. This is the force that tends to cause the ship to pivot, which occurs when its moment around the fore-poppet becomes greater than the moment of the weight around the same point.

The pivoting point, therefore, is represented on the diagram by the intersection of the curve of the "moment of buoyancy about the forward end of the sliding ways," and the straight line representing the "moment of the weight of the hull" about the same point. By considering the curve of buoyancy, the force supporting the hull at this point is determined and the difference between this and the weight of the hull gives the pressure on the fore-poppets at the time of pivoting. This pressure, which in the case of the *New York* was calculated to be 2110 tons, requires special arrangements for its distribution, as, if localized, it would deform the hull. These arrangements will be discussed farther along.

In order to determine whether there will be a tipping force, curves are drawn showing the moment of the buoyancy around the outer end of the ground ways, and the moment of the weight of the hull around the same point. If these do not intersect there is no danger of tipping. In order that the vessel will not drop when the end of the ways is reached, the curve of buoyancy must pass above the line representing the weight of the hull at a point on the diagram represented as inshore of the end of the ground ways.

The calculations represented by the curves are made considering the ship as fixed at each point. This does not represent accurately the conditions when the vessel moves down the ways, when dynamic forces enter into play. Furthermore, due to the movement of the vessel in the water, there is a stern wave and consequent hollow, which has the effect of tending to modify the buoyant forces and no doubt causes the actual pivoting to take place at a different point than indicated by the calculations which are based on consideration of static forces.

Very great care must be exercised in making the calculations and providing against all contingencies, as unforeseen circumstances may prove fatal to the success of the launching, or even cause the loss of the ship. For example, in the case of the launch of the French ship *Danton*, at the Brest naval arsenal, in May, 1909, the vessel stopped on the ways after moving only about 160 feet. It became necessary to rebuild the launching ways and the vessel was not launched until forty-two days later. The

difficulty was caused by the fact that account was not taken of the unusual resistance of the water caused by the launching of the ship between two parallel walls at a short distance on each side.

THE BUILDING SLIP.

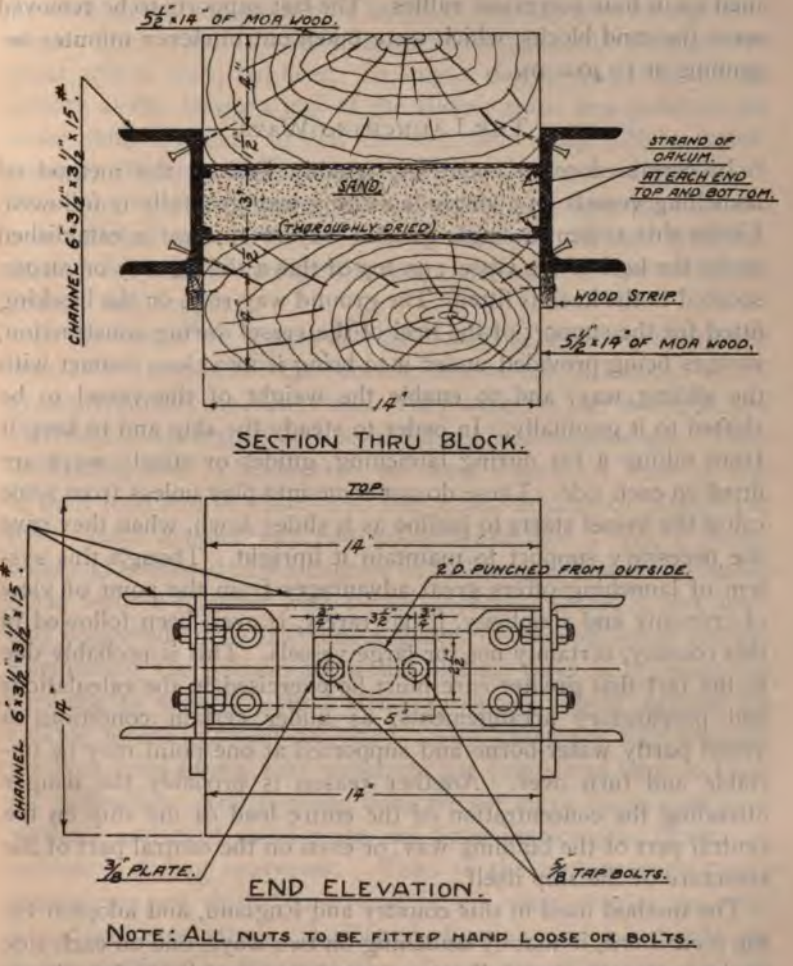
The question of the successful launching of a ship is considered before it is laid down on the building slip, which must be designed to permit the necessary arrangements for the launching to be made as simply and economically as possible. Building slips, therefore, are placed in locations with reference to the water's edge permitting the ship to be launched by sliding. The slips are arranged to allow placing under the ship launching ways having an inclination such that the component of the force of gravity is sufficient to overcome the friction between the sliding surfaces of the launching ways. At the same time the inclination must permit the ways to be carried into water deep enough to float the ship. The slip is arranged with as small inclination as possible, having in view the necessity later of placing the launching ways under the ship, and of providing clearance for the fore foot while sliding down the ways and after pivoting.

Large ships are launched almost universally stern first on sliding ways, which extend in the direction of their length, though infrequently, due to restricted water or building space, ships are launched broadside on. The reason for launching ships stern first rather than bow first is somewhat in question. The practice has been followed many years, and it lends itself satisfactorily to new conditions as they arise. The principal reason is probably that the shape of the stern of the vessel is such that it floats off more satisfactorily from the ways, and the shape of the bow lends itself better to suitable poppet packing. Then, too, more resistance is offered in this way by the water and the length of the run is accordingly less.

Frequently special measures are necessary to reduce the speed of the vessel after it is launched on account of restricted water. No such steps were necessary for the *New York* as there is ample space in the East River in the direction in which she was launched, and the deep after packing, five feet thick in itself, offered considerable resistance.

The principal difficulties of launching large vessels are those that result directly from the necessity of shifting the support of

The advantage of these lies in the facility with which they may be removed by allowing the sand to escape. At the same time they were capable each of supporting safely a load of 125 tons. The reg-



SKETCH SHOWING ARRANGEMENT OF COLLAPSIBLE SAND BLOCKS USED UNDER THE KEEL OF THE "NEW YORK." THE BLOCKS ARE RELEASED BY REMOVING THE SAND EITHER THROUGH THE SMALL HOLE OR BY UNBOLTING THE SIDES.

ular yellow pine keel blocks which were left in place under even frames from 2 to 98 were split out the morning of the launching.

On the morning of the launch all remaining supports, except the tumbling shores, were removed progressively, in the meantime the wedges between the packing and the sliding ways being rammed up in four successive rallies. The last supports to be removed were the sand blocks, which were taken out in eleven minutes beginning at 10.30 a. m.

THE LAUNCHING WAYS.

In certain foreign countries, notably France, the method of launching vessels on a single launching way generally is followed. Under this system a single ground way or *coulisse* is established under the keel of the vessel; on top of this a sliding way or *savate*, secured to the keel, is fitted. The ground way rests on the blocking fitted for the support of the keel of the vessel during construction, wedges being provided under it to bring it into close contact with the sliding way, and to enable the weight of the vessel to be shifted to it gradually. In order to steady the ship and to keep it from taking a list during launching, guides or steady ways are fitted on each side. These do not come into play unless from some cause the vessel starts to incline as it slides down, when they give the necessary support to maintain it upright. Though this system of launching offers great advantages from the point of view of economy and simplicity, it has rarely, if ever, been followed in this country, certainly not for large vessels. This is probably due to the fact that greater care must be exercised in the calculations and preparatory arrangements, as under certain conditions a vessel partly water-borne and supported at one point may be unstable and turn over. Another reason is probably the danger attending the concentration of the entire load of the ship on the central part of the building way, or even on the central part of the structure of the ship itself.

The method used in this country and England, and adopted for the *New York*, is that of launching on two ways, one on each side of the center, the usual distance apart being one-third of the beam of the ship, though this is subject to variation to bring the ways under portions of the structure best able to withstand the pressures incident to launching a ship, and over suitable piling of the building slip. The ground ways are secured to the building slip, their upper surfaces being in a plane inclined to the horizontal at the angle determined as seen above. Sufficient space must be allowed

between the ground ways and the bottom of the ship at its lowest point to permit the sliding ways, packing and wedges to be fitted. These considerations and the clearance of the stem at and after pivoting serve to determine the height of the ship above the ground ways. Their width is made to conform to that of the sliding ways which will be discussed later. In length, they extend from a point inshore at the forward end of the sliding ways to a point in the water sufficiently far so that the ship practically will be water-borne by the time the forward end of the sliding ways passes off. This point is of importance, as if when the ship does pass off and is insufficiently water-borne, it may drop off the end with too much force and be damaged through striking the bottom or the ground way supports.

In the case of the *New York* the launching ways were the same ones as were used for the *Florida*, lengthened on account of the greater length of the *New York*. They were 620 feet in length, and extended to a point 197 feet beyond mean high water mark. Their inclination was 11/16-inch to the foot, a drop of over 35 feet in their total length. Each had also a cant inboard of ½-inch per foot. Each ground way had a sliding surface 5 feet, 6 inches wide and consisted of six courses of yellow pine timbers 12 inches thick, secured together with 1-inch steel bolts spaced 3 feet apart and staggered. The fastening together of the courses of timbers constituting the ground ways and sliding ways is of great importance to secure a rigid structure securely held against the racking forces to which subjected. Also, under the high pressure the launching grease may penetrate the joints and tend to burst the fastenings. The securing bolts are set up on large steel plate washers, and hard wood coags are fitted between the timbers to prevent a sliding movement. Butts of the timbers constituting the courses are shifted and those in the outer courses are reinforced with steel straps. A ribband of yellow pine 4-inches by 14-inches was fitted on the outer edge of each ground way to eliminate the possibility of the sliding ways leaving the ground ways. In order to hold the ground ways securely against the spreading forces brought into play, spur logs were fitted at intervals of eight feet on the outer sides of each ground way. A clearance of 2 inches to 3 inches is allowed between the ribband and the sliding ways.

The dimensions of the sliding ways are determined primarily by the length and launching weight of the vessel, although it is customary to use launching ways on hand, if they can be adapted. It has been found in practice that it is not safe to exceed certain values for the unit pressure of the sliding ways on the ground ways. If the pressure is excessive the value of the coefficient of friction becomes too great to permit launching, due to the fact that the lubricant that is used between the sliding surfaces will be forced out before the vessel can be launched, or even during the actual launching.

On recent launchings of large vessels the following unit pressures per square foot of the sliding ways obtained:

Vestal	2.14 tons
Connecticut	2.18 "
Florida	2.30 "
Wyoming	2.17 "
Arkansas	2.42 "
Utah	2.25 "
Texas	2.38 "

The pressure in the case of the *New York* was 2.39 tons to the square foot.

It is evident that it is desirable to have the sliding ways as long as possible. Due, however, to the shape of the ship it is not possible to extend them to its full length. The forward ends, or "fore-poppets," especially can extend no farther than a point where they can be so secured and fitted to the ship as to give ample support during pivoting, at which time, as has been seen, a large part of the weight is concentrated here. In way of the fore-poppets, therefore, the hull itself must be sufficiently strong, or permit being supported, so as to stand this force without deformation. The length of the sliding ways in general, is about eight-tenths the total length of the ship, in the case of the *New York* it was 437½ feet, the effective length being 426 feet, the overall length of the ship being 573 feet. Their width was 5 feet.

The length of the sliding ways having been determined, the width is determined readily by considering the launching weight of the ship, the length of the sliding ways and the unit of pressure which it is desired to obtain. In the case of the *New York*, as has been seen, the launching ways that had been used on the *Florida* were on hand, and in order to minimize the expense it was decided

to use them, after lengthening. The sliding ways were each in three sections. The two stern sections were held together by outside straps, and the third section was secured by a slip pin for convenience in removing after launching. The thickness of the sliding ways is determined to some extent by the method of release. When this is effected by sawing off sole pieces at the forward end of the sliding ways, these must be of sufficient strength to hold the ship against its force of impulsion down the ways. Another consideration is the necessity of sufficient rigidity and stiffness of the sliding ways to prevent their deformation under the wedging-up process; also safe handling in and out of water without breaking. Satisfactory compliance with the above considerations will generally give sufficient rigidity for release by a trigger as in the case of the *New York*.

The sliding ways were constructed of five courses of 12-inch yellow pine timbers, bolted with 1-inch steel bolts spaced two feet apart and staggered. The bolts were set up on steel plate washers, coaged, and the butts of the outer course of timbers were strapped with steel plates.

METHOD OF RELEASE.

As the final preparations for the launching advance, and the blocks, cribbing and shores that supported the hull during construction are removed and the weight is transferred to the launching ways, the force of impulsion which ultimately causes the vessel to slide down the ways comes into play. In order that the vessel may not get away until the appointed time and all arrangements shall have been completed, some means must be used to hold it, and at the same time to permit its being released promptly when desired. The method utilized most generally, and the one followed heretofore at the New York yard, is the expedient of extending the ground ways and oak sole pieces securely fastened to the sliding ways slightly forward of the fore-poppets, and fastening them together solidly. To release the ship the sole pieces are sawed through at the forward end of the sliding ways.

In the case of the *New York* it was decided to adopt the launching triggers, one for each side, which had been utilized previously with success in launching the sister ship, the *Texas*. The device consists of heavy steel bell cranks or triggers fitted on horizontal axes let into the ground ways. The upper arm of each of these

triggers, when upright, takes against castings set into the sliding ways. They are held in this position by hydraulic cylinders with pistons pressing against the lower arms of the triggers. The cylinders are cross connected and the pressure can be put on the pistons by means of a small hydraulic pump. By opening the escape valve the liquid in both cylinders is freed simultaneously, releasing the triggers and the sliding ways. Safety pawls are

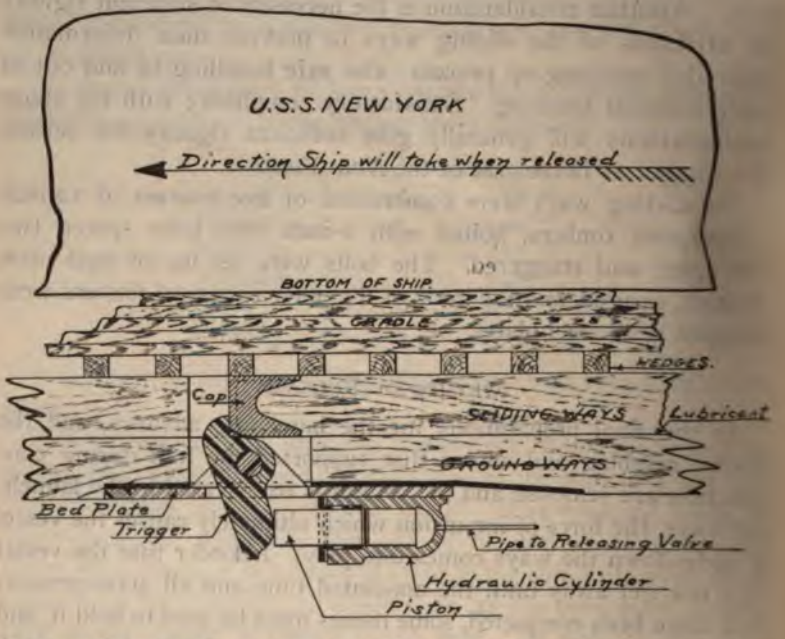


DIAGRAM SHOWING ARRANGEMENT OF HYDRAULIC RELEASING TRIGGERS, TWO OF WHICH WERE USED FOR THE "NEW YORK."

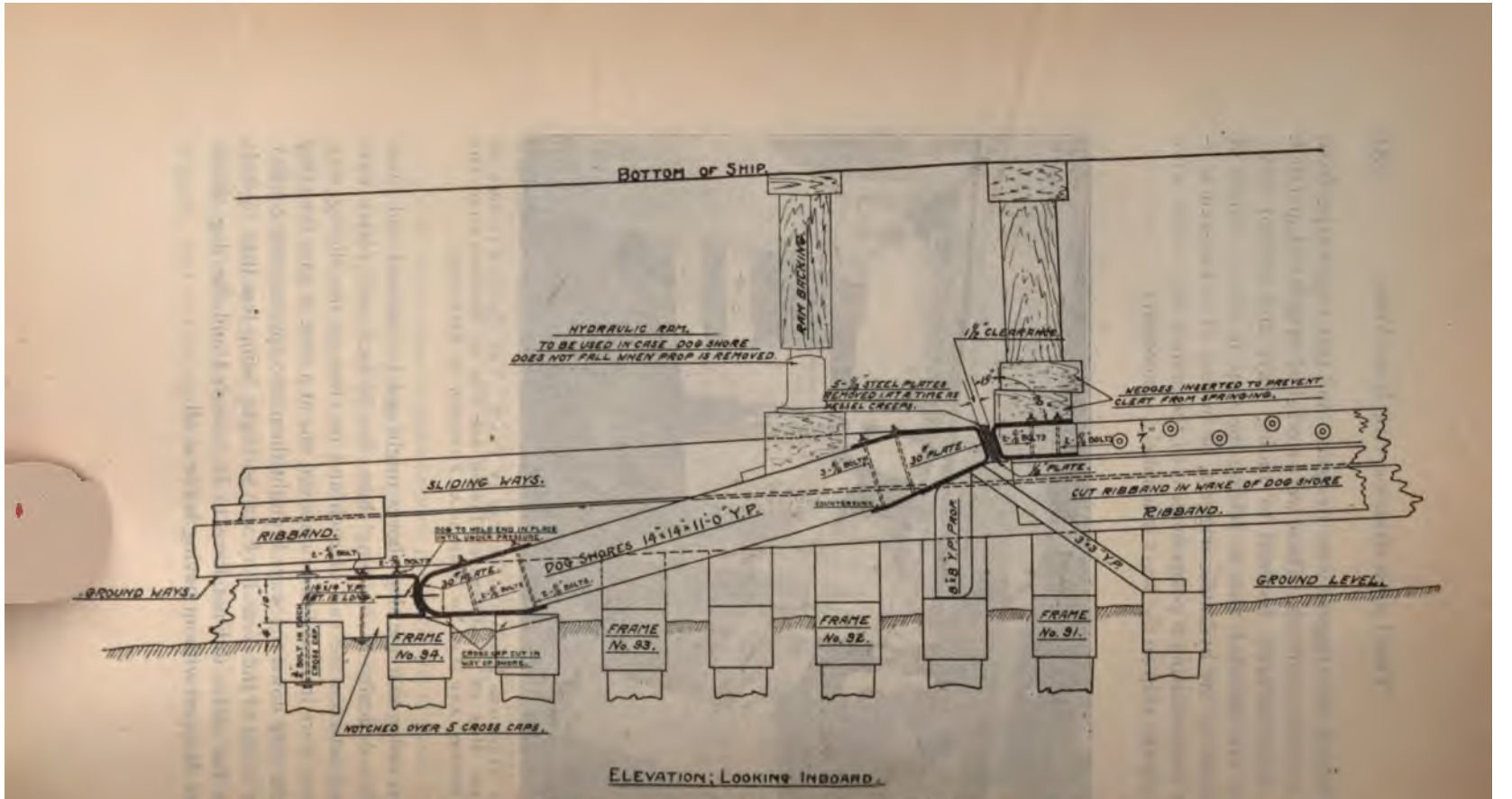
provided, which when in place prevent positively the triggers from dropping. Pressure gauges are provided to show the pressure on the interiors of the cylinders, which is an index of the force being exerted on the trigger. Before the *New York* was released this pressure went to 2000 pounds per square inch.

In addition to the hydraulic triggers, dog shores of 14-inch square yellow pine were provided, one on each sliding way. These were intended to hold the ship in case of accident to the hydraulic triggers, and to take up unexpected excess pressures, over those

for which the triggers were designed, and that might arise from unforeseen conditions. These were steel shod on each end, and took on cleats securely fastened to sliding ways and ground ways. They are intended, also, to release the ship, in case of failure or accident to the hydraulic triggers, or in case of unforeseen accident necessitating a postponement of the launch they would serve to hold the ship on the ways indefinitely, if necessary.

THE STARBOARD RELEASING TRIGGER IN PLACE. THE SMALL CYLINDER ON LEFT HAS AN AIR-OPERATED PISTON FOR USE IN MANIPULATING THE TRIGGERS, AND HAS NO PARTICULAR FUNCTION IN RELEASING.

In order that the dog shores might not be jammed and cause undue difficulty in dropping them, five ¼-inch steel plates were fitted between the end of each and its cleat on the sliding way. These were intended to be removed one at a time in case the creep of the ship down the ways brought them into approximate contact. The creep of the *New York* was so slight, being less than ¼-inch, that the plates did not have to be removed and the dog shores were dropped without having borne at all.



ELEVATION; LOOKING INBOARD.

DIAGRAM SHOWING ARRANGEMENT OF DOG SHORES, TWO OF WHICH WERE USED PRECAUTIONARILY ON THE "NEW YORK."

It frequently occurs that due to the initial friction of the grease or the holding effect of the tumbling shores, a vessel does not start when released. In order to give it initial motion four hydraulic rams were provided, two of 150 tons power and two of 100 tons. These were placed at the forward end of the ways taking against a backing log bolted to the ground ways, and a cross timber bearing directly on the ends of the sliding ways. The *New York* started at once when released and no use was made of the starting rams.

THE LUBRICANT.

The question of a proper lubricant between the sliding surfaces is of great importance, as on it depends largely the success of the launching. If it is too soft it will be forced out by the pressure, or if too hard the coefficient of friction will be unduly increased. In determining the degree of hardness of the grease, consideration must be given obviously to the unit pressure and the probable temperature of the air the day of the launch. The lubricant was applied in a total thickness of about 5/8-inch. Beef tallow was the principal ingredient, the others being stearine and launching grease. The launching grease is softer and is intended to give the initial lubrication, until the harder tallow melts under the friction. Lard oil was poured in the openings left by the separators just before the launch, also, to aid in giving initial lubrication. It had been customary at prior launchings at the New York yard to fit the launching ways completely in place, providing means for removing the sliding ways with their packing to permit applying the grease just prior to the launching. In the case of the *New York* it was decided to apply the grease when the ways were first installed, which covered a period from September 15 to October 15, 1911. To protect the grease during this period from being squeezed out, steel separators 5/8-inch thick were fitted between the sliding ways and ground ways, at intervals of ten feet. These were removed the day before the launch. Separators were also used with the former method. To prevent dirt from entering the space between the ribbands on the ground ways and the edge of the sliding ways, strips were nailed along. These, too, were removed the morning of the launch. In order to hold the sliding ways in their proper position laterally, with respect to the ground ways, thumb toggles are used. These consist of blocks

of oak 2½-inches in width inserted between the outer sides of the sliding ways and the ribbands on the ground ways.

In order to grease the submerged portion of the ground ways for a distance of about 30 feet below low water mark, two coffer-dams were used, one on each way, which permitted exposing a section on each of 30 feet in length. An oil torch was used to dry the wood prior to the application of the grease, which was made the two days preceding the launch. Grease distributers, also, were provided, consisting of boxes, one at the end of each sliding way, filled with grease and provided with a weighted piston to force it out as the ship moved down the ways. These were fitted to provide lubricant for the remaining ungreased portion of the under-water ground ways.

FORE AND AFTER POPPETS AND PACKING.

Due to the form of the ship, and the necessity for extending the ways the maximum length possible, it is necessary to introduce a considerable amount of wood or packing between the upper surfaces of the sliding ways and the hull of the ship. This must be solidly fitted so as to give firm support to the ship, and must be carefully adjusted to the shape of the hull to distribute evenly the weight. Over the central portion the packing for the *New York* consisted for the most part of 4-inch by 12-inch yellow pine planks planed carefully to uniform thickness and piled in a manner similar to brick work, about 200,000 board feet of lumber being used. At the forward and after ends, where more packing was needed, yellow pine timbers 12 inches square were used. The packing on each side was in three sections, exclusive of the "fore-poppets." It was separated from the sliding ways by oak wedges eight feet long and six inches square at the base, spaced 14 inches apart. These were depended on to bring the packing tight against the hull, and by taking its weight at least partly, to aid the removal of building supports. One hundred and thirty four-handed battering rams of live oak 6½ feet long and 6 inches square were provided to drive the wedges, which were rammed up in four rallies, each extending six minutes.

At the forward and after ends of the ship, due to its wedge shape, there is a spreading force on the ways which is met by lashings securing the poppets on each side together. The after-poppets on the *New York* were secured by four lashings of 10-

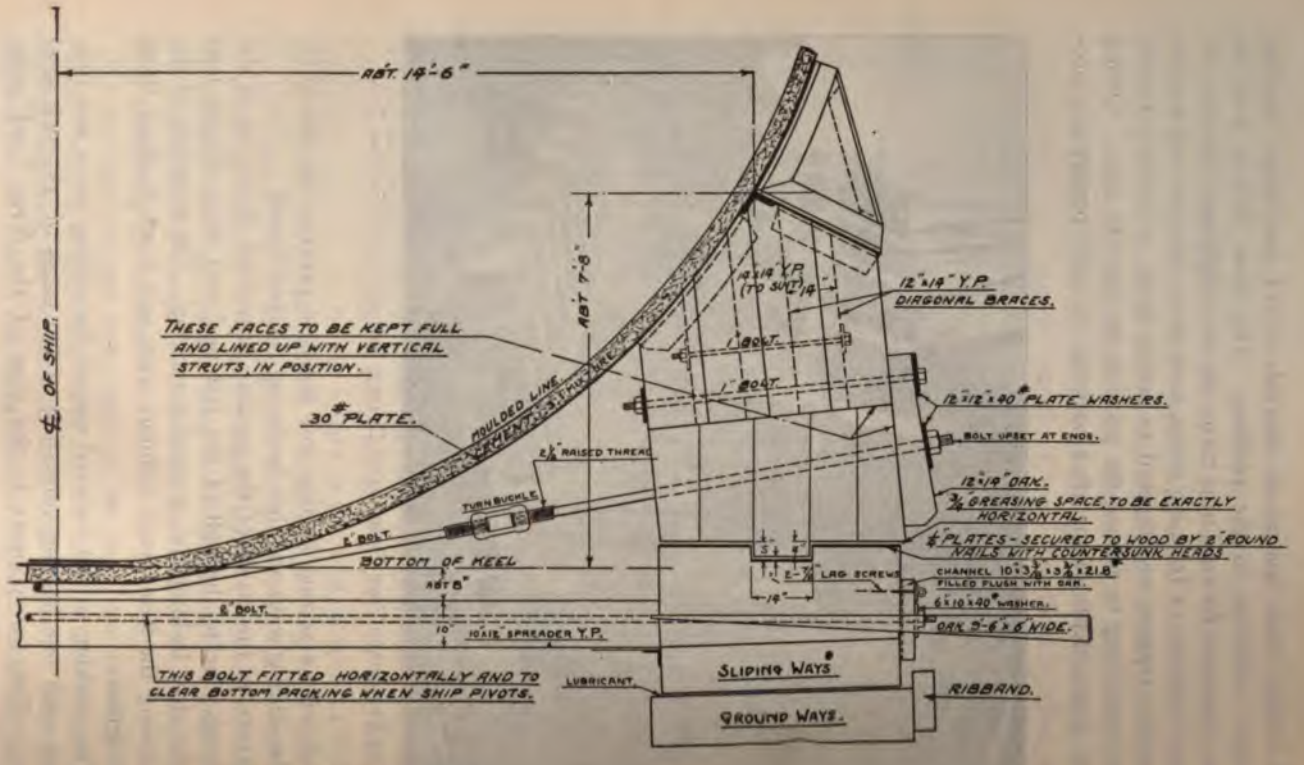
inch hemp rope, spaced at intervals of 13 feet apart, passing through openings in the packing. The after lashing had ten turns, the next forward nine turns, the next eight and the next six. These lashings, or frapping turns, were hove taut over oak toggles 14 inches square, and tapered to permit being withdrawn readily after launching to release the packing on opposite sides. Owing to the great depth of the after packing, the after-poppet was pro-

THE STARBOARD FORE-POPPET AND CRADLE, SHOWING ALSO SLIDING JOINT.

vided with a second lashing low down to prevent the spreading of the sliding ways and thus becoming ribband-bound.

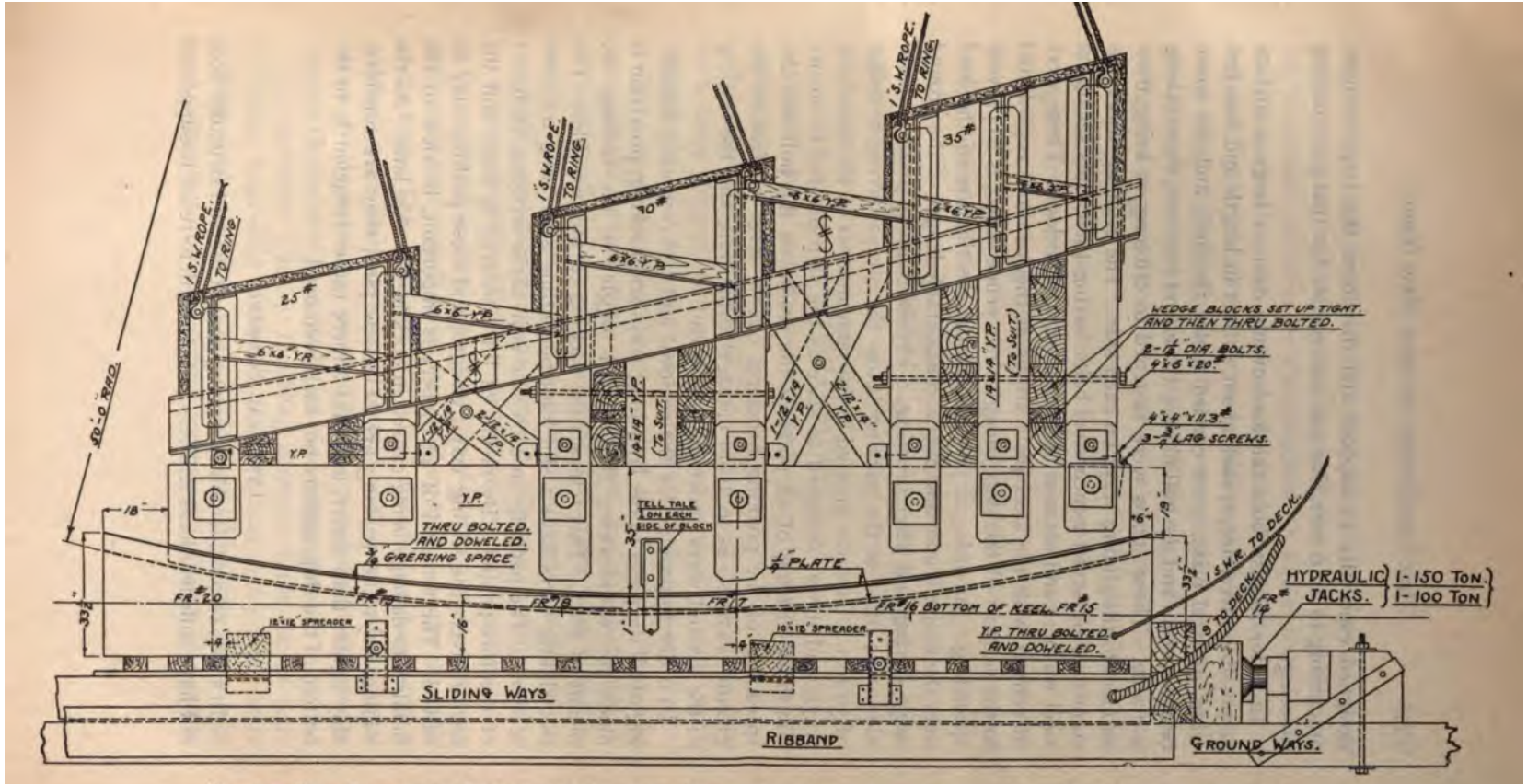
Struts on the inside of the packing prevented closing in of the packing, due to the pull of the lashings, and their oblique lead at the after lashing also prevented racking. The morning of the launching the hemp rope lashings were wet down to draw them still tighter.

The packing at the forward end of the sliding ways was provided with one lashing consisting of ten turns of 3½-inch steel rope. The fore-poppets in the case of the *New York* were



SECTION AT FRAME Nº 17.

CROSS SECTION SHOWING ARRANGEMENT OF FORE-POPPET AND CRADLE, ONE SIDE ONLY SHOWN.



VIEW OF FORE-POPPET AND CRADLE FROM OUTSIDE. CURVED LINE SHOWS THE SLIDING JOINT ARRANGED FOR PIVOTING.

designed especially to support and distribute the large weight, amounting to 2110 tons, that was concentrated at that point during pivoting.

In order to distribute the load evenly over as large a surface as possible three straps, each about 40 feet in length and five feet wide, of steel plate, were carried under the hull, and the space between them and the hull filled with cement concrete, thus making a cradle. These straps were fastened to cribbing to bring their support to the sliding ways on each side. The cribbing was cross-connected by seven 2-inch steel bolts having their ends set up on steel washers and set taut by means of turn buckles. These were in contact with the steel plate straps at the keel and contributed to the support of the ship, though their prime object is to prevent spreading. In order to provide for the distribution of the load over the entire cradle and over a considerable length of the ground ways during and after pivoting, a circular sliding joint, or trunnion, was fitted in the packing below the straps having a radius of 50 feet. This was greased in the same manner as the launching ways, and it was designed to slide as the ship pivoted to ensure continued bearing of all parts of the cradle on the hull and the spreading of the pivoting pressures over a large surface of the ground ways, so as to avoid damage to the hull, and the settling of the ground ways under the heavy load.

In order to provide for the removal and recovery after launching of all the parts of the launching ways and packing, provision is made for withdrawing the tapered toggles in the lashings by means of lines. This releases the packing on the two sides. The two sliding ways have a slip joint permitting separating into two sections. The packing on each side is in three sections, exclusive of the fore-poppet. By means of lines secured to them and the use of divers the sliding ways, wedges, and loose packing may be salved. The removal of all timbers is important, in view of the liability to damage being caused in docking the ship later. As the sliding ways and packing are of yellow pine, they are considerably lighter than water, and thus adhere rather tenaciously to the bottom of the ship, and are not easily removed.

INTERNAL SHORING.

In a ship of considerable launching weight the hull structure does not have sufficient local stiffness and strength to resist unsupported

the forces brought to bear over the launching ways. For this reason internal shoring is generally necessary. On the *New York* the sliding ways were placed under a longitudinal. A line of shores were fitted on each side of this between outer and inner bottom. In way of athwartship bulkheads and between boilers three rows of shores were fitted. Special diagonal braces were fitted in certain localities to reinforce bracket floors. Special shoring was fitted in way of the fore-poppets between frames 15 to 20 to resist the crushing forces exerted by the fore-poppet cradle during pivoting. This extended to the upper platform and was cross-braced securely to bring the crushing forces in opposition to each other.

To support the long span between bulkheads in the boiler rooms heavy shoring was carried from the top of inner bottom, between boilers, upward to the armor and gun decks.

All boilers were in place, also considerable auxiliary machinery, and all the shafting from the thrust shaft aft; a total of about 750 tons.

SPECIAL FEATURES.

Certain special features were comprised in the above launching arrangements as follows:

(a) *The Trunnion Type of Fore-Poppets.*—This has been used by a large shipyard in this country, and is used in some yards abroad—It is not expensive and is believed to do its work well.

(b) *Cement Concrete Between Hull and Poppet Straps.*—Its use with the trunnion type of fore-poppets is particularly advantageous, as all the straps are brought up to their work simultaneously. The ship was greased to prevent adherence of the cement to the ship, and thus facilitate removal. Cement is easily poured in, whereas wood is difficult to fit behind a 5 to 6-foot strap.

(c) *Collapsible Keel Blocks.*—These should not be confused with sand bags, which have poor holding power in the direction of the keel. They consisted of a 6-inch channel bar frame with a 5½-inch wood block on top and bottom, with three inches of sand between. By unbolting, the sand flows out and the block is loose. Similar blocks have been used abroad to some extent.

(d) *Extended Use of Tumbling Shores.*—Such shores have heretofore been used under the keel aft, and under inner after docking keels. In the case of the *New York* they were also used under the entire length of the outer docking keel. Their prin-

cipal function is to guard against the grease being squeezed out before the moment of release. They operated in an entirely satisfactory manner. For some time before launching they served the ordinary purpose of supporting the ship.

(e) *Grease Box at End of Ways.*—This was also used when the *Flordia* was launched. It has not been customary at the New York yard to grease the ground ways under water to the extreme end, and the grease box is intended to do this. It costs little and it has been thought well to take this precaution.

WORKMEN EMPLOYED.

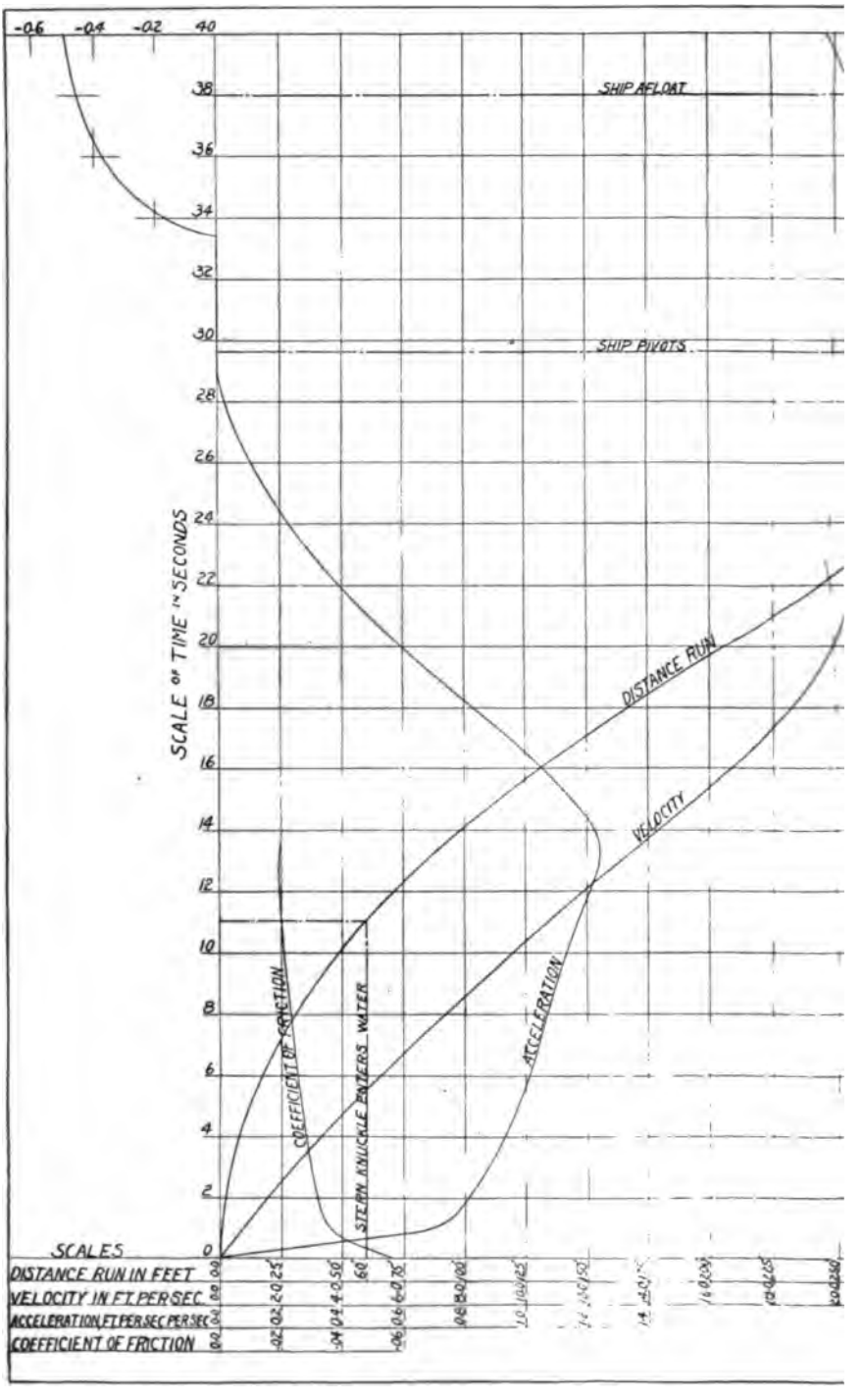
Launching a large vessel is of sufficiently unusual occurrance in the navy yard to require the special organization and training of the gangs for each launching. During a launching in a navy yard there is no economy in reducing the number of workmen employed as the navy yard closes for the day and all workmen are given full pay in any event, so that as many as can be used to advantage are employed. A detailed station bill was prepared for each man to be employed in the launching operations of the *New York*, and they were given buttons to permit them to pass inside the lines, and to distinguish them from other workmen not actually employed. The general conduct of the launching was under the direct charge of the construction officer, assisted by the naval constructor charged with the immediate supervision of the construction of the ship. A naval constructor was in immediate charge of the gangs on the ground on each side of the ship, and two were on board.

The force for ramming up the wedges consisted of about five hundred men, principally shipfitters and helpers, riveters and chippers; each gang containing four men was assigned to ram up six wedges. Signals for beginning and ending the rallies were given by waving white or red flags abreast the releasing pit where the construction officer had station. Gangs of shipwrights were organized for splitting out the keel blocks and cribs and cutting out shores. Laborers and riggers were assigned to move the blocks and other material clear of the ways, and painters to touch up bare spots after removal of shores and blocking. Machinists were stationed by the launching triggers and hydraulic rams for starting the ship. Details of shipfitters were made to look for holes or defective caulking in way of cribs, shores and blocks.

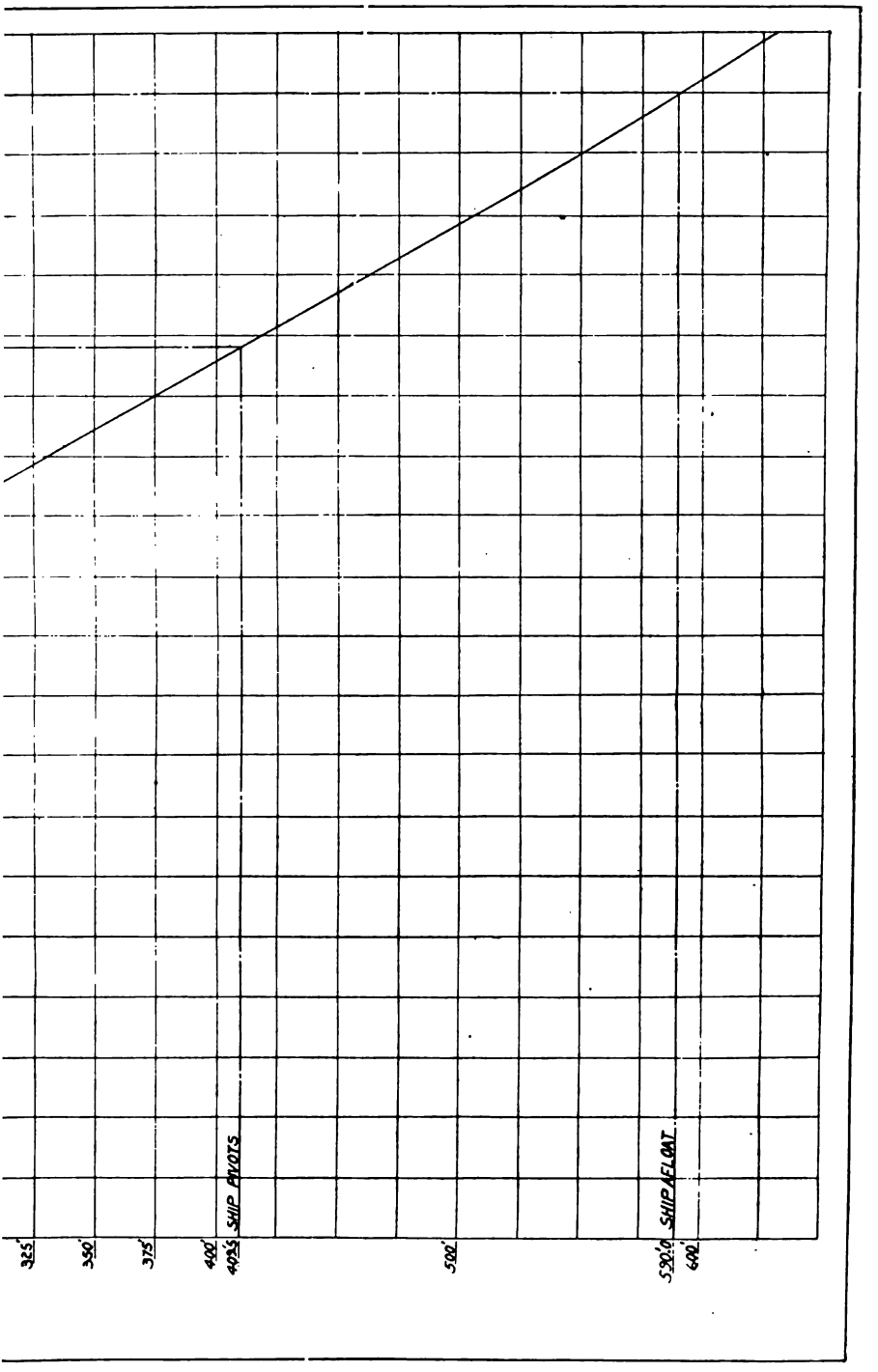
On board plumbers were detailed to take soundings promptly after the ship was launched, and to pump out any compartments found to be making water. Machinists were stationed by all outboard connections to make good any leaky valves. Inspection

THE LAUNCHING OF THE "NEW YORK." PRESIDENT TAFT AND SPONSOR'S PARTY IN THE BACKGROUND.

gangs were detailed to make examination for damage done to the hull that might be experienced during launching. One man was stationed by the bow to break the bottle of champagne, in case of failure of the sponsor to accomplish that, and also to rescue the broken bottle and the holder. A tug with steam connection stood by after the launch to give steam for pumping, if needed.



CURVES SHOWING DATA TAKEN IN LAUNCHING, USED IN DETERMINING COEF



TION OF SLIDING SURFACES, AND CURVE OF COEFFICIENT OF FRICTION DEDUCED.

THE INVITED GUESTS AND SPECTATORS.

The publicity attending the launching of a large vessel in the navy yard, and the presence of the President of the United States, served to make the invitations issued by the Secretary of the Navy especially sought after, and to attract a large crowd of spectators, estimated at 40,000. A platform to accomodate 1500 persons was erected at the head of the ways, on a level with the sponsor's stand, for the President and the guests of the Secretary of the Navy. Enclosures on the starboard side were arranged for officers of the station, their families and guests, and for yard clerks, draftsmen, their families, and other persons requiring special consideration. The port side of the ship, the cob-dock and causeway leading to it, were reserved for the yard workmen, their families and friends, enlisted men from the ships and the general public. A special road was roped off to conduct the President and his suite from the landing to his stand.

Different gates were specified for each of the main classes of tickets and for vehicles, and the streets were roped off so as to direct persons to the proper part of the yard as called for by their tickets.

OBSERVATIONS TAKEN.

For the purpose of making observations, recording data and notes as to progress of work, a number of draftsmen were stationed at various points on the ship and on shore. The principal observations taken were for the purpose of determining the speed and acceleration of the ship down the ways, and the deflections in the structure caused by the stresses set up during launching.

The speed was determined by noting the times marks on the sides of the ship, at known distances apart, passed the observers. There were four stations, two on each side. One observer at each station sighted the marks and touched the other observer, who noted the positions of the hand of a split second watch on a circular strip of paper pasted on the dial. This gave time intervals which enabled calculations to be made for speed and acceleration, and from this the coefficient of friction is determined.

Observations for hogging or sagging were taken with a transit instrument on deck and athwartship deflections from a stretched piano wire. Measurements were made of distance from inner bottom to main deck to determine local deformation, if any. How-

ever, no deflections of any importance were noted on the *New York*. Records were kept of the progress of the operations and the time consumed for each. This record is of value for subsequent launchings in making up the program.

LAUNCHING PROGRAM.

The various launching operations were previously scheduled and were executed on the day of the launch as per schedule.

The *New York* was launched at 11:00:30 a. m., October 30, 1912.

SCHEDULE OF TIME.

4.30 Early launching gang reports.
- (a) Final greasing of ways to low-water mark.
- (b) Wet down manila frapping aft.
- (c) Remove dirt strips.
- (d) Diver to examine condition of ways.
- (e) Report from diver on condition of ways.

7.45 All officers report.

8.00
- (a) Full launching gang and all observers report for duty.
- (b) Test voice tubes and warning whistle.
- (c) Test launching trigger and hydraulic rams, then close space over launching trigger.
- (d) Set clocks.
- (e) Start pouring lard oil.
- (f) Set creeping indicators and trunnion indicators.

8.18 Stand by for first rally.

8.20 Begin ramming.

8.26 Stop ramming.

8.27 Start splitting out keel blocks, working from aft.

8.33 Stand by for second rally.

8.35 Begin ramming.

8.41 Stop ramming.

8.42
- (a) Reports on clearance of dog shores by officer in charge on each side.
- (b) Report of conditions on board by officer in charge.

8.43 Remove shores under bilge keels (white).

8.45 Receive reports from Machinery Division regarding valves, etc.

8.58 Stand by for third rally.

9.00 Begin ramming.

9.06 Stop ramming.

9.10 Start removing side cribs.

9.15 Disconnect air and water lines.

9.30
- (a) All keel blocks should be out. Report by Master Shipwright.
- (b) Report on clearance of dog shores.

9.58 Stand by for fourth rally.
10.00 Begin ramming.
10.06 Stop ramming
10.08 (a) Remove ramming shores between ways.
(b) Side cribs should be out.
(c) Clear away stage plank in way of tumbling shores under docking keels where inaccessible.
10.12 Report on tide.
10.15 Begin removing sand blocks, beginning aft (this was actually begun at 10.30).
10.20 Disconnect electric lines to ship.
10.25 Receive report from ship that air ports, manholes, doors, etc., are closed and everything ready on board.
10.30 Report all thumb toggles out by officers in charge on each side.
10.35 Disconnect speaking tube on board.
10.40 (a) Hoist warning signal to river.
(b) Remove gang plank.
10.45 Trigger and hydraulic pump men to stand by.
10.50 (a) Sand blocks should be out.
(b) Stand by to remove docking keel tumbling shores in case this becomes necessary.
(c) Reports that everything is clear of ship by officers in charge on each side.
(d) Report on tide.
10.55 Report on clearance of dog shores.
10.56 Warning whistle:
1 blast—stand clear. (This is also warning to sponsor.)
10.57 Report all men out by officers in charge on each side.
10.58 Warning whistle:
2 blasts—drop dog shores.
10.59 Report dog shores out by officers in charge on each side. (Personal report.)
11.00 Release ship by Naval Constructor in charge.

"ON BOARD"—OUTLINE OF ORDERS, ETC.

8.00 All men report for duty.
8.05 Test voice tube to releasing pit.
8.06 Make personal inspection of ship as to condition, lines, collision mats, leak stoppers, etc.
8.15 Receive reports from foremen on board regarding men, tools, etc.
8.16 Order inspection of inner bottom compartments and closing of manholes.
Order all air ports and doors closed.
Order all hatches ready to batten down.
8.42 Report condition on board.
9.15 Disconnect air lines.
10.00 Receive report on soundings from Master Plumber.

10.20 Disconnect electric lines.
10.25 Report that all doors, air ports, etc., closed and that all is ready on board.
10.35 Disconnect speaking tube.
10.40 Remove gang plank.
10.45 See that man is stationed at bottle line; see that men are stationed at lines and at anchors.
11.15 Receive report on soundings with copy of report from Master Plumber.

LAUNCHING OF THE "NEW YORK."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVAL DISCIPLINE.

By CAPTAIN CHARLES F. POND, U. S. Navy.

Captain Fullam's timely article on "Absence Overleave in the Fleet"[1] is meeting with a fair measure of response from the service. Following it, the Navy Department in February last, addressed a circular letter to commanding officers requesting suggestions regarding the schedule of punishments for summary courts martial and deck courts, as laid down on page 185, "Forms of Procedure, 1910." The following is the substance of my remarks submitted in obedience to the above-mentioned request, and now, with the Department's permission, laid before the readers of the PROCEEDINGS for their consideration:

1. The schedule for punishments for summary courts-martial and deck courts laid down on page 185 of "Forms of Procedure, 1910," is in my opinion excellent and should be adhered to. It has been very consistently followed on this ship, the U. S. S. *Pennsylvania,* with excellent results.

2. The one criticism that I have to make is that it is not complete in that no provision is made for absence overleave for less than twenty-four hours, and that the offenses, "petty theft," "having the articles of another in possession" (a rather common offense), "selling, bartering, exchanging, pledging, loaning, or giving away any portion of uniform or outfit" (see Article 204, U. S. Navy Regulations) and also another common offense, "careless or willful loss of government property," and "profane language," are omitted. The latter I would include under the next to the last offense cited, making it read "threatening, abusive, profane and obscene language," For "petty theft," "having articles of another in possession," "selling, bartering, etc., portion of uniform or outfit," and "willful destruction of government property," the maximum days' loss of pay should be awarded, it being understood that for these offenses, and others where different degrees of criminality attach, the court should use discretion in awarding sentence. Such offenses should be marked on the scedule wth an awarding and a note appended to the above effect. For "loss or destruction of government property by carelessness," loss of pay to cover value, ordin-

[1] U. S. Naval Institute Proceedings, volume No. 37, No. 4, 1911.

arily the invoice price, should be adjudged not to exceed the maximum allowed by law. This is in line with recent regulations concerning the custody and care of government property and will have an excellent effect besides tending toward economy.

3. To the schedule of punishments there should also be added regulations regarding liberty for which there is crying need of uniformity throughout the service. I cannot too strongly urge this point.

4. Forwarded herewith is a proposed schedule of punishments and regulations regarding liberty now in force on this ship and which is practically the same as the one which has been in force on this ship during the past three years under my command. Under this schedule no such condition has obtained as described by Captain Fullam and other officers as being common among the ships of the Atlantic Fleet. While offenses have not ceased, and under any system will never cease entirely, there has been a steady and marked improvement in the conduct of the crew and many cases of complete reformation. As showing the excellent standing of the crew of this ship the following summary of conduct classes on the first of the present month speaks for itself:

Special first class	275
First class	204
Second class	3
Third class	11
Fourth class	12

5. Analyzing the appended schedule:

Paragraph 1 is similar in effect to the note at the bottom of page 185, "Forms of Procedure, 1910." On a schedule emanating from the Department the wording of the above mentioned note should be followed. Confinement is a degrading punishment and should not ordinarily be adjudged. Other minor reasons against confinement as a mode of punishment are lack of cells on modern ships and the useless labor involved in guarding and policing prisoners. When adjudged, the rule of one to three implied in Article 30 of "Articles for the Government of the Navy" should be followed, viz., one day's confinement for each three days' loss of pay.

Paragraph 2 begins with providing for absence overleave for less than twenty-four hours and follows the spirit of the schedule for longer absences except that the loss of five days' pay for the offense is omitted. The result is that for a first offense of short absence a minor punishment is awarded. For repeated offenses of this character the cumulative provision of paragraph 5 comes in with good effect which would be in a measure lost were the five days' loss of pay adjudged for each minor absence in addition to the one, two or three days' pay laid down in the schedule. A man habitually overleave for but a few hours, but who, for the fourth and subsequent offense, gets a checkage of twenty days' pay is apt to begin thinking and correct his habits. This has been the experience on this ship. It is also believed that a sharp line should be drawn between absence for less than twenty-four hours and longer absences, and this the schedule does. Absence of less than one hour, or tardiness, is infre-

quent and is generally checked by reproof or slight restriction. In awarding punishment at the mast the man's record should always be consulted, and, where the offense with previous record considered would not warrant a punishment exceeding twenty days' loss of pay, a deck court should be awarded for simplicity of procedure; where the punishment with previous record considered would exceed twenty days' loss of pay a summary court-martial should be adjudged.

Paragraph 3 follows the schedule as laid down on page 185, "Forms of Procedure," with the additions heretofore noted. A save-all clause is added covering less serious but not petty offenses for which summary punishment may be given by the commanding officer in the shape of solitary confinement on bread and water not exceeding five days. Any other confinement except for safe keeping, etc., is obsolete or obsolescent.

Paragraph 4 provides for the reduction to fourth conduct class of any man convicted before a deck court or summary court-martial of any offense save overleave for less than twenty-four hours, or who has been awarded confinement as a punishment. Except in special cases men on this ship are not otherwise reduced in class, except from special first to first in accordance with navy regulations. In consequence we have practically what is known as "the free gangway." Restriction is seldom awarded as a punishment except where it is considered better for a man's health or morals that he should remain on board, and a man overleave less than twenty-four hours may go ashore the day after his fine is paid; provided, it is his turn to go. The result of the application of this rule has been excellent and the Department might well consider appending an advisory clause to that effect to the schedule and regulations when revised and reissued.

Paragraphs 5 and 6 provide for cumulative punishments for previous offenses, and, in this connection, special attention is invited to the rule laid down in paragraph 6 for treatment by summary courts-martial of previous convictions in cases which would not have come under the cognizance of a summary court. Paragraph 5 follows the procedure of the schedule of punishments issued by the Department in 1908 and the two rules together appear to fully cover the suggestion in the 5th paragraph of the Department's letter, viz: "Whether there should be any different rule, with respect to convictions, if the earlier trials were had before a summary court-martial or before a deck court," These rules have been in successful practice on this ship since the 1910 schedule was issued.

Paragraph 7 provides for petty offenses and prescribes the manner in which extra duty shall be performed. As a commanding officer for a period covering over thirteen years of service, I have consistently discouraged the bringing of petty offenses to the mast, but there are certain occasions when such offenses must be considered. Such offenses should be punished by extra duty and rarely by restriction and the extra duty should be such as not to degrade the ordinary work of the ship, even the menial work, and should be worked off outside of working hours. The time limit should also be explicit. Seventy-two hours or three days extra duty generally means nothing definite and is generally mostly shirked, even

when the master-at-arms endeavors to be conscientious. The scheme provided appears to meet every requirement. Four hours extra duty carries over into the second night, and rarely is a heavier punishment than that required. The provisions for doubling extra duty for offenses committed while undergoing extra duty and for repeated offenses of the same character are extremely salutary, the latter tending to correct bad habits, such as "articles in lucky bag," "ditty box adrift," etc.

Paragraph 8 gives notice to the crew that long restrictions will not be enforced except under certain necessary circumstances.

Paragraph 9 gives the general regulations regarding liberty: These are very liberal and are believed to be consistent with the best practice. They have given perfect satisfaction on this ship to both officers and men, and it is earnestly suggested that these, or similar uniform rules, be issued for the guidance of the service. Uniformity of privileges should go with uniformity of punishments and both together will go far toward perfecting contentment among the enlisted personnel. The personal equation can never be eliminated, nor is it desirable that it should be, but that there should be uniformity as near as may be, of privileges and punishments as well as of organization and routine, which latter has been practically achieved, cannot be successfully controverted.

6. It is believed that there is nothing in the foregoing to conflict with existing laws.

GENERAL REGULATIONS REGARDING PUNISHMENTS AND LIBERTY.
U. S. S. "PENNSYLVANIA."

1. Summary courts-martial and deck courts will be guided by the following schedule in awarding punishments:

In awarding loss of pay the limit should ordinarily be adjusted, but, for those offenses marked with an asterisk (*) the degree of criminality should be considered in awarding the sentence. Confinement of any kind will be awarded only in exceptional cases and in any case should not exceed one-third the number of days for which loss of pay is adjudged.

The foregoing simply expresses the mind of the commanding officer as revising authority and is not intended to limit the power of the courts as laid down by law:

2. Over staying liberty:

Not over 1 hour	Warned, or for repeated offenses, 1 week's restriction or 3 hours extra duty.
1 to 8 hours	Deck court limit loss of 1 day's pay.
8 to 16 hours	Deck court limit loss of 2 days' pay.
16 to 24 hours	Deck court limit loss of 3 days' pay.
1 to 4 days	Deck court or summary court martial depending on record. Limit loss of 5 days' pay for the offense and of 4 days' pay for each day and 1, 2 or 3 days' pay for each additional fraction thereof absent.

More than 4 days	Summary court-martial.	Same limit as above.
Absence or attempted absence without leave	Summary court-martial.	Limit loss of 15 days' pay for offense and same as above for time absent.
Absence without leave using another's name to avoid draft.	Summary court-martial.	Limit 30 days' loss of pay for the offense and same as above for time absent.

If delivered after absence with or without leave add 5 days' loss of pay to above.

Twenty-four hours or more overtime, or absence without leave involves loss of pay for the time so absent, exclusive of the amount forfeited by sentence of court.

3. The following offenses subject the offenders to trial by summary court-martial or by deck court:

Offense.	Number of days loss of pay.
Disobedience, deliberate	Maximum.
* Disorderly conduct	15
* Disrespect to commissioned or warrant officer	Maximum.
* Disrespect to petty officer	60
Drunk, not having been on liberty	30
Drunk, on duty, post or guard	Maximum.
* Failure to obey	Maximum.
* Falsehood	Maximum.
Gambling	30
* Having articles of another in possession	Maximum.
Leaving post or watch	Maximum.
Liquor unlawfully in possession	15
* Loss or destruction of government property through carelessness.	Loss of pay to cover value up to maximum.
Missing ship after absence with or without leave	30
* Neglect of duty	Maximum.
* Petty theft	Maximum.
Resisting arrest	30
Returning from liberty unfit for the proper performance of duty.	3
Returning in civilian clothes	10
* Selling, bartering, exchanging, loaning, or giving away portion of uniform or outfit.	Maximum.
Sitting down on post or watch	15
Smuggling or attempting to smuggle liquor	15
Surrendering at another station	30
* Threatening, abusive, profane or obscene language	Maximum.
Willful destruction of government property	Maximum.

Other less serious offenses may be punished by solitary confinement on bread and water not to exceed five days.

4. Conviction by deck court or summary court-martial, except for overleave not exceeding twenty-four hours, or confinement of any kind, except for safe keeping or awaiting investigation, carries with it reduction to fourth conduct class from date of offense.

In general men will not otherwise be reduced in conduct class except from special first class to first class in accordance with navy regulations.

5. Before a deck court each previous conviction during current enlistment including for overstaying leave for less than twenty-four hours, involves an additional loss of 5 days' pay.

6. Summary courts-martial will not take cognizance of previous convictions by deck courts for overleave for less than twenty-four hours, but other previous convictions will be treated as follows:

In case of a second conviction for a case of a similar nature the punishment will be doubled, and for a third or subsequent conviction, either the maximum or a bad conduct discharge will be adjudged. If the offense is of a different character increase by 15 days' loss of pay.

7. For petty offenses extra duty will be awarded and for offenses committed while undergoing extra duty and for repeated offenses of the same character double the usual punishment will be awarded.

Extra duty will consist of duty on the quarterdeck under arms between the hours of 8.00 and 11.00 p. m.

Extra duty will be worked off as rapidly as weather and other circumstances will permit.

Men on extra duty list or on report awaiting mast or investigation, or in debt as the result of punishment, or prisoners at large will not be granted liberty except under special circumstances.

8. No person will be deprived of liberty on shore for more than two months, except in case of confinement by sentence of court-martial or when awaiting trial, or unless the exigencies of the service or the unhealthiness of the port prevents giving liberty.

9. Conditions permitting, and for stay in port not exceeding thirty days, general liberty will be granted as follows:

Special first class	Every other day.
First class	Every fourth day.
Second class	Once in two weeks.
Third class	Once in three weeks.
Fourth class	Once a month.

Under special circumstances chief petty officers, special first class, may be granted liberty each day after working hours.

When stay in port exceeds thirty days' liberty for special first class may be reduced to every fourth day (liberty by sections), with such special privileges for chief petty officers as may be expedient.

About the time the foregoing was written the Department authorized senior officers present, upon request of commanding

officers, to discharge as undesirable not exceeding one per cent of the crew each quarter, providing the men so discharged were in their first enlistment. Had this authorization been in effect at the time I assumed command of the U. S. S. *Pennsylvania,* in July, 1909, I would gladly have availed myself of it to have weeded out a certain undesirable element among the crew, but coming at the time it did, after the above system had been in force for nearly three years, there was little occasion for its use. The element in question, though continually reinforced by new comers, had practically been eliminated. However, it is a most excellent provision, and combined with a schedule as above laid down would, in my opinion, leave nothing to be desired in the way of punitive regulations.

I have read and reread with great interest Captain Marbury Johnston's excellent article upon "Discipline in the Navy," in the September number of the PROCEEDINGS, but must beg to disagree in toto with his conclusions as to the proper remedy for serious infractions of discipline.

There is no such thing as a universal panacea for wrong doing either in civil life or in the navy, and Captain Johnston exaggerates when he says "Just as soon as the men in the service find out that all liberty breaking and serious infractions of discipline will be punished by immediate discharge as undesirable, just so soon will it be stopped." Had he said "lessened" or "checked," the expression would have been more exact, and with such a statement I doubt if anyone would disagree. The death penalty has not stopped murder however much it may have checked the crime.

Captain Johnston appears, moreover, to have confounded military with moral offences, or at all events has classed them together. For the latter, if serious, I would most decidedly agree that summary discharge is the proper remedy, and one per cent a quarter should cover most of such cases, but for the former I believe that more than one warning may in certain cases be advisable. So much depends upon environment, both before and after enlisting, that, for infractions of purely military discipline, no hard and fast rule for punishment can safely be laid down. In the case cited of Hansen, if it were true that he deliberately overstayed his leave after a plain statement in his hearing of the rule, and the penalty for infraction thereof, then his absence was much more than a

mere absence from work or from duty for a few hours, and he richly deserved the consequences. Indeed one can imagine no other result in a properly conducted military service, and the effect upon the remainder of the crew was no doubt most beneficial. I would not from that case, however, argue that every man overstaying leave for six hours, or even a much longer time, should be summarily discharged even if it were a second offence. In this connection it appears to me that the rule laid down for guidance of summary courts on page 185 "Forms of Procedure for Courts and Boards, 1910," viz., "in case of a second conviction for an offence of a similar nature the punishment should be doubled, and for a third or subsequent conviction, either the maximum or a bad conduct discharge should be adjudged," is safe and sane, and needs no modification. Referring to this rule, it would appear from the cases cited by Captain Johnston from the enlistment records of his ship that someone had been derelict in enforcing the plain directions of the Department. Recently in an attorney's office in Seattle, Washington, I was poring over a musty law book, "Statutes of the State of Washington," one of several volumes, when a bystander, a lawyer and an Englishman, remarked: "The State of Washington has more laws than all the United Kingdom." When one remembers that Washington is a comparatively new state, and only one among forty-eight, to say nothing of the Federal Government itself, the vast volume of American law is at once apparent. The point is this (and Governor Thomas R. Marshall, in an excellent article entitled "The Automatic Citizen," in the September Atlantic Monthly, makes identically the same point) as a people we are too much given to making laws and too little given to executing them, and it is only too true that the navy in this respect but reflects the customs of the people.

While agreeing thoroughly with Captain Johnston in his remarks about the doing away with irons as a punishment, I disagree in toto with his following statement that "the establishment of the deck court was a distinct step backward." I consider it a most decided step in advance, and if thereby captains succumb to the temptation to shirk their duty, the remedy is obvious, viz., to discipline the erring captains. I do not consider, however, that the "temptation" is so great as Captain Johnston would have us believe, but rather that the deck court is a very proper relief of the commanding officer from petty duty, and a step toward more

perfect justice. As for a fine as a punishment creating dissatisfaction, it can affect only those who have offended, and what would Captain Johnston have—a punishment which pleases? The fact that it does not please is only a proof and measure of its efficacy.

I fear that Captain Johnston is again exaggerating slightly when he suggests that were his ideas adopted, all apprehended deserters should be sent to St. Elizabeth's, or some institution for the feeble-minded. Derelicts who are neither insane nor feeble-minded will enlist and desert, and the only remedy that I can see is more care on the part of the recruiting officer. Improvement along this line has been very marked in recent years, but there is room for more. As for fraudulent enlistment being a thing of the past, recent general court martial records do not bear out this statement, nor will they cease entirely until more care is taken at the fountain-head, viz., the recruiting office.

To sum up it appears to me that the present regulations regarding discharge for misconduct, combined with the privilege given commanding officers of discharging as undesirable one per cent of the crew, per quarter, are ample, *if enforced*, to rid the service of its bad characters. Captain Johnston's own statement of the effect produced when he mustered aft the some fifty bad characters on his ship and informed them of his determination to carry out the Department's directions, viz., that only two subsequently committed themselves, is ample proof of the efficiency of the present system—*when carried out*. I quite agree that "all that is needed to make the discipline of the navy what it should be is to start the steam roller and threshing machine, crush out the bad ones, and winnow out the worthless ones." I disagree only in believing that we have had the steam roller and threshing machine already provided. Nothing more is needed than the perfecting of the present system as described in this paper, and as put in practice on the U. S. S. *Pennsylvania*.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE U. S. NAVAL DISCIPLINARY BARRACKS, PORT ROYAL, SOUTH CAROLINA.

By MAJOR CHARLES B. HATCH, U. S. Marine Corps, Comdg.

For some time the Department has believed that the method formerly in vogue, whereby the great majority of offenders against naval discipline were sent to naval prisons and discharged from the service, was a most expensive form of punishment, and one which did little towards the ultimate end in view, that of reforming the offender.

It had been found that a large percentage of prisoners confined in naval prisons were men who had committed purely military offenses and who, on completing their terms of confinement, would be dishonorably discharged from the service, thereby making it impossible for them ever to return thereto. Quite a number of these prisoners were trained men who, in a spirit of thoughtlessness, had committed themselves, and to sever permanently their connection with the service without making some effort to make them realize their mistakes, and at the same time save generally good men for the service, was considered far from meeting the modern idea of dealing with offenders. No attempt had been made up to this time to separate criminals from those confined for purely military offenses, and the whole idea in confinement seemed to be to make the offenders "pay" for their offenses, putting aside, as it were, what should be the chief resultant of all punitive institutions, reformation of character.

To devise means for separating the military and criminal offenders, and to give the former an opportunity to regain their self-respect and remain in the service, if they so desired, the Department convened a board composed of Captains Robert L. Russell and Henry B. Wilson, U. S. Navy, and Major Charles B. Hatch, U. S. Marine Corps, with orders to investigate the conditions of the service, and to recommend such changes in the system then in vogue which, in the opinion of the board, would give the best results. After a careful investigation as to existing conditions in naval prisons the board recommended as follows:

Enlisted men convicted by court-martial should be classed under three heads and dealt with as follows:

(1) *Those Convicted of Crimes not of a Purely Military Nature.*—It is believed that men convicted of criminal offenses should not be confined with those convicted of purely military offenses, only. All cases of filthy nature, theft, and cases where the offenses are not of a purely military character should be sent to state prisons. Arrangements were made with the New Hampshire State Prison at Concord, N. H., in December, 1910, for the confinement therein of naval prisoners, and such arrangements are now in existence with the Connecticut State Prison, Wethersfield, Conn., and the California State Prison, San Quentin, Cal.

(2) *Those Convicted of Military Offenses whose Separation from the Service is Necessary or Desirable.*—Men convicted of desertion from the navy or marine corps must in all cases be sentenced to dishonorable discharge, and their enlistment is expressly prohibited by law. Other cases arise where the offense committed or the record of the offender is such that the retention of the man in the service would be undesirable. All such men should be confined in naval prisons, and dishonorably discharged upon expiration of confinement in accordance with the terms of their sentences. Should the sentence not include dishonorable discharge in such cases, other than desertion, the man should be discharged as undesirable upon expiration of confinement.

Prisoners confined in naval prisons should be allowed only such plain, wholesome rations as may be necessary for their health and general welfare. The selection of guards for naval prisons, their pay, and period of service should be governed by the recommendations made below with reference to guards for "detention quarters."

Persons confined in naval prisons should be worked ten hours per day, if possible, and some means of useful employment should be supplied. The manufacturing of coal bags is suggested as best serving this purpose. However, if this is impracticable, any form of labor which would be beneficial to the government should be allowed.

* * * * * * * *

(3) *Those Convicted of Purely Military Offenses Who may be Developed into Desirable Members of the Service.*—In our opinion, enlisted men convicted of purely military offenses, with the exception of such cases specified in class 2 above, should be confined in detention barracks or camp, termed "detention quarters." Rigid discipline should be maintained at such places of detention, officers being detailed for duty thereat who are known to be good disciplinarians, and, also, who possess a good knowledge of human nature. Enlisted men who may be thus confined should wear the service uniform and should not be known as "prisoners" as the term is usually applied. They should be put through a carefully selected course in service drills and instructions so that at the end of their detention they may, if recommended as desirable, be returned to the service as proficient as possible. During the time under detention their pay and leave should be stopped as at present, the men being allowed only their uniforms and such other articles, including tobacco, as may, in the opinion of the officer in command, be deemed necessary for their health and comfort.

As respects rations, men in detention should be given the regular rations, except desserts, special holiday meals, and extras. . . .

Upon being released from confinement in detention quarters, men not discharged should be placed on probation at the place of detention, allowed liberty, and given the same amount of work and responsibility as would be given them if they were placed on probation on board ship or at barracks. No man, with the possible exception of a very few special cases, should be placed on probation in the general service; that is, on board ship, at naval stations, or in barracks.

Officers on seagoing ships or in regular barracks have not the time to devote the necessary amount of attention to the cases of men serving under their command on probation.

The place selected for "detention quarters" should not be a makeshift. It should have good airy barracks, plenty of ground for drill and exercises, and should be located in a temperate climate so that outdoor drills could be carried on the year round.

The men to be used for guards should be carefully selected men of known excellent character, they should receive extra pay and be kept on this duty during good behavior. Owing to emergencies frequently arising which now require the detail of men on prison duty to other stations, it is recommended that men so detailed as guards be not transferred unless the call for their services elsewhere is extremely urgent. It is believed that in thus selecting men as guards fewer will be required and better discipline will be maintained.

We believe that in most respects the best location for the proposed "detention quarters" would be at the naval station, Guantanamo, Cuba. However, owing to the expense and other obstacles—especially the necessary frequent transfer of men to and from Guantanamo—it is recommended that for the present the proposed "detention quarters" be located at some place in the southern part of the United States where outdoor drills can be carried on the year round.

It is strongly recommended that the "detention quarters" feature be tried out for a period of at least one year, by the transfer of not less than three hundred men to such point as may be designated for the "detention quarters" where this idea could be thoroughly developed and given an opportunity to demonstrate its value to the service.

As will be understood from the foregoing, the objects of the proposed system are, first, to prevent enlisted men convicted of offenses solely against naval discipline from being subjected to the stigma attaching to imprisonment, and, second, saving to the service of a large number of such men who give promise of becoming, under proper discipline, desirable members thereof. With this in view, it is recommended that there be adopted a form of punishment to be termed "detention" and that in cases that may be deemed worthy of such clemency the Department mitigate sentences of imprisonment to "detention."

* * * * * * * *

In accordance with this report the Department directed that a detention barracks, to be known as the U. S. Naval Disciplinary

Barracks, be established at Port Royal, South Carolina, placing in command the writer of this article, together with six marine officers, two medical officers and one pay officer, with the necessary enlisted force to carry out the work.

During the fiscal year 1912 some four hundred fifty enlisted men have been sent to Port Royal instead of the naval prison for confinement, the terms of their sentences having been mitigated by the Department to detention. These men, instead of being placed in prison garb, retain their service uniforms, are drilled and exercised as though serving at a regular station, and are at all times kept occupied in some form of healthy work or exercise.

On completing two-thirds of their sentence in the detention barracks, from which no liberty is granted, and where strict discipline is maintained, those detentioners whose conduct has been excellent are placed on probation for the remaining third of their sentence. During this period of probation they receive service pay, are granted liberty, and are treated in every respect like men on duty in the service at large. During this period the officers at the Disciplinary Barracks are able to judge just how these men will act in service, and whether or not their retention therein is desirable.

Those men who show during their period of detention that they are undesirable are discharged from the service in accordance with the terms of their sentences, or as undesirable in cases where their sentences do not include discharge, and men found desirable at the termination of probationary period are unconditionally restored to duty and sent to some receiving ship for general detail in the service.

If it happens that a detentioner's enlistment has expired in detention, or would expire during the probationary period, he is discharged from the service at the expiration of his period of detention, and if his conduct warrants such action, he is recommended for re-enlistment. In a number of such cases the man concerned has applied for re-enlistment the day after his discharge, and has been re-enlisted at Port Royal, the commanding officer there having been designated as a recruiting officer by the Department for such purpose. During the fiscal year 1912 one hundred men who, under the old form of confinement in naval prisons, would have been lost to the service, have been returned to duty. Twenty-one others who, on account of expiration of enlistment, could not be restored to duty, were recommended for re-enlistment.

This form of punishment permits the enlisted man to retain

his self respect, there is no stigma of prison garb or life attached, and he goes into the service a better man morally and physically, and the service gains in receiving a lot of well-drilled men who in the past were lost by discharge.

As much responsibility as may be compatible with discipline is given detentioners. Every effort is made to encourage them to assume that amount of responsibility which is held by any well-trained and disciplined body of men. The detentioners at Port Royal are divided into companies, each company having its acting petty officers detailed from its own strength, and officers and non-commissioned officers are detailed to drill them.

Six mornings of the week are devoted to four drill periods each, during which the detentioners are exercised in all the service drills, including infantry and field artillery. The afternoons are devoted to general work around the post, and to athletic exercises. Everything possible is done to keep the men busy and interested in their work. Those detentioners who have trades such as carpenters, painters, plumbers, blacksmiths, machinists, etc., are in addition to their drills worked at their trades making repairs to the buildings, boats, and machinery in order that they may be as efficient as possible on returning to the service. Helpers are detailed with these men for the purpose of giving the assistants an opportunity to learn a trade for themselves.

Port Royal had been abandoned as a naval station for a number of years and the buildings there were, when the disciplinary barracks was established, in poor repair. A few days before the post was established the place was visited by a severe storm which uprooted all the large trees, some ninety in number, broke nearly one thousand window glasses, unroofed five of the large buildings and left the place generally in a deplorable condition. All these repairs have been made by the labor supplied by the detention and probation barracks, making it unnecessary to employ outside labor and thus saving a considerable sum to the Department. In fact, the entire post, including the water pumping station, heating and lighting systems, is run by enlisted men.

During the fiscal year 1913 it is the intention of the officers at Port Royal to start classes in special work, where detentioners, in addition to their regular service drills, will be taught useful trades which will be of benefit to themselves as well as to the service on their return to duty. These classes will be in seamanship, with boat drills under oars and sails; signals, both day and night; sailmakers, learning to perform the work of a sailmaker's

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mate on board ship, and a class of radio operators. For the last named a small radio station will have to be established at Port Royal, and an experienced operator will be sent there as an instructor.

In addition to these special classes the character of the drills are to be extended. Practice marches will be frequently taken, the men will be instructed in field fortification, landing operations, advance and rear guard formations and outpost duty, target practice with the service rifle, and in fact every service drill which will make them more efficient.

By a rearrangement of the duties of the officers at Port Royal, and on the reporting of an additional officer, it will be possible to detail three officers to duty in the detention barracks, where from one hundred seventy-five to two hundred fifty men have been quartered.

With officers interested in this kind of work, men who will devote their entire time to working with the detentioners, helping them individually, and keeping them interested in their advancement, it is considered that the detention idea is a success, and that the service as well as the detentioner is to derive great benefit from it.

The men received at the Port Royal Disciplinary Barracks for confinement are not criminals, but men who have committed some offense against naval discipline. Generally speaking they are men of good character who, through lack of forethought, or during a moment of uncontrolled passion, have allowed themselves to commit offenses of which in saner moods they are repentant. Human nature is frail but is generally amenable to correction and discipline if properly administered, and while all men at some time make mistakes, it does not necessarily follow that all men are bad.

It has been found that some good may be found in nearly every detentioner, and that it only requires the well directed energy of an officer to bring this good to the front. Individual treatment and help on the part of the officer often saves a man from being lost to the service, and it is believed that in this individual work lies the success of the detention idea. Certainly there is no better work in the service; none which will show better results, and the more work and effort on the part of the officers, the more men saved from themselves for the service.

At a time when the whole country is interested in prison reform work, the detention idea in the service brings the navy prominently to the front in its efforts to assist offenders against its discipline.

COMMANDANT AND SUBORDINATE STAFF, ALDERSHOT DETENTION BARRACKS.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

REFORMATORY TREATMENT OF SOLDIERS AND SAILORS UNDER SENTENCE OF DETENTION.

By LIEUTENANT-COLONEL G. HAINES, British Imperial Service, and Commandant Detention Barracks, Aldershot, England.

I am very willing to write all I know on this subject, but it is impossible to lay down hard and fast rules where every case differs in various degrees from the next.

Our latest revised rules have been placed at your disposal. They are as complete as such things can be. It is in the method of obeying those rules that the real difficulties lie, although they have been compiled with extreme care to meet those difficulties.

Even a drill book is a weary thing without the drill instructor, and *he* must have the knack of imparting its contents, so that his hearers may understand and remember what they are told.

I fear this fact was made only too apparent in my article entitled, "Punishment as Applied to Soldiers and Sailors," which was so kindly and generously received by your magazine, and I am encouraged, by the reception accorded to my maiden effort, to write anything I can to assist in bringing about reforms which are evidently needed, and to unravel the maze of tangles which beset our path in the first few years of evolution in England.

I must try and imagine that, in addition to being very much with you in the spirit, I am actually "alongside" in the flesh; and that after having greeted the American officers who have visited my establishment, and taken a bird's eye view of our system, I say "Well, gentlemen, its time we make a start"—and I take charge right away.

What have we got that we can do without?

What can we put the pen through as being fundamentally antagonistic to "Reform"?

There are several such, but they all come under one head, viz. *Stigma.*

1. Penal treatment,
2. Prison clothing,
3. Prison terms, the word
4. *Prison*, and
5. All degrading and non-productive employment, and life, or rather "existence," behind locked doors.

I never could see why any sailor or soldier, who has broken the naval or military laws of discipline, should be branded for all time. I am glad to see that the reformation of convicts is not considered hopeless nowadays; and, provided the crime does not come under the head of "cruel and unnatural," and it is not a monstrous or hideously cowardly kind, I think the brand of Cain can be dispensed with.

But there are other good and sufficient reasons why a sailor or a soldier should not be liable to carry the mark of the beast. To put it simply, *his family don't like it.*

A family (A) which has produced soldiers and sailors, and which merits its country's thanks, may produce *one* "bad hat." Another family (B) which has not as yet produced any recruits, but fully intends to put their lads into one or other of the services, sees what has happened to (A), and all its boys go into something else.

In reforming A's "bad hat," and keeping him free from stigma, you return him to his family in his right mind, earn the family's gratitude, and you need not fear obstruction in that quarter. Moreover, the stigma of a prison reacts upon the man when he becomes a civilian. It lasts a life time. This is obviously wrong *if* "it is [really] never too late to mend."

Let us therefore rule out stigma—and find something to replace it.

It is a sticky thing and must be made to adhere *only* to the man who richly deserves it.

In the first place the automatic process is the most potent aid.

Gratitude for the removal of disgrace is going to help you more than you would at first credit. The men themselves will do more than half, by showing how they appreciate a real boon.

The technical difficulty lies in the business of making the treatment, divested as it is of degradation, deterrent in the highest possible degree. This is a matter of training.

The officers entrusted with this work (they must be commis-

sioned officers) must necessarily be highly trained men. They must carefully train the staff under them. They must make very few, if any, mistakes, and they must know thoroughly well all matters connected with the service to which they and the men under detention belong.

Well-meaning men are so often hustled into trouble by the ignorance and incapability of junior non-commissioned officers.

Their chief faults are:

Inability to wield authority,

Eyewash,

Impatience, and swelled head.

Such men cannot command respect, and they *make crime.*

When a man comes to the Aldershot Detention Barracks he finds himself under a staff of experts, and he realizes how easy it is to behave well under such circumstances. He knows more about his profession on leaving than the non-commissioned officers described above; and he knows how to avoid running foul of such people.

Some time ago I had a very interesting example of this.

A man arrived with a name for being a desperate character. I was warned about him by his commanding officer. He had evidently been badly adrift. He was slovenly, idle, and inclined to be insubordinate. After a time I began to notice something about him which interested me. His appearance on parade was improving, his movements were brisker, and his surly look had disappeared. Later he became one of the smartest fellows in the place. His "turn out" was splendid. His shooting was beautiful. He could almost write his name on the target. He looked you squarely in the eye, and his room was a marvel of neatness and cleanliness. Shortly before his release I had a long chat with him.

At last I asked him, "How is it that you can soldier in a place like this, and not with your corps"? He ripped out instantly with the reply, "Well, sir, there ain't no —— lance corporals here!"

He rejoined his unit, *I* have not seen him since, so I suppose he is doing well.

"Prison" means "Punishment."

"Detention" means "Reformation."

"Prison" is a sad and sordid place for all concerned with it. It is a very necessary, nay, indispensable institution; but not for men serving for the honor and safety of their fatherland on land and sea.

"Detention" is elevating, progressive, instructive, healthy and reformatory in every way—but,

Is detention deterrent? A fair question. The answer is emphatically *Yes.*

Statistics amply prove this, and you have them in your possession.

The numbers of committals for years past have steadily diminished, until the absence of crime in the army has become a matter of particular interest in this country.

The reason is that *the men* have got to know about detention. Those who know it by experience have told their comrades who do not, and the strenuous routine of the "busy day" is looked upon as a thing to avoid. Then again, *the officers* have got to know the system.

Here in Aldershot, and in all stations where there are detention barracks, every young officer has to attend for instruction, and dozens of the senior ones come voluntarily.

The other day a company officer said to me, when leaving after lecture, "Well, *now* I don't mind so much if my fellows miss *company training* by being sent here, I find they lose nothing."

Officers commanding units come as visitors, and they recognize the utility of the place and send men in to have their weaknesses eradicated and their ignorance removed by the careful individual attention which they cannot receive in their corps.

A notorious burglar found himself landed here some time ago. He had enlisted, of course, under an "alias," in order to try and shake off his old associates, and go straight. There were several convictions against him, and he had done time in most of our large convict prisons.

I found him a very interesting man to talk to, and I asked him his opinion of our system. He was good enough to approve of the principle, "*but*," said he, "there is a great deal too much work here, sir; if I had got a long sentence (he was doing 28 days), I shouldn't stay with you!" I suppose he was as clever at getting out of places as he was at "effecting an entrance." I look upon this gentleman's testimony as a high compliment to the deterrent effect of detention.

In order to make the routine of a detention barrack real and genuine, and the treatment reformatory, it should have a capacity limited to hold only 200 men, or thereabouts.

Soldiers Under Sentence at Work. Military Instruction.

There are only 24 hours in the day, and only 10 of these can be spent in reformatory work of the right "individual" kind.

Men must be informed on admission of what is going to happen to them, and it is up to the commandant and his staff to see that it *does* happen to them. No angry shouting, no harsh words, no pushing or shoving, none but naval or military words of command; or by bugle, whistle, etc., but plenty of quiet advice, patience, help, sympathy. The mere "dignity" of the thing has its effect.

The staff should be hefty and strong, well set up and of good appearance. This generally will be found in the non-commissioned officer who is finally confirmed in his appointment, after a course of probation.

He is in every sense a picked man, a "sealed pattern." The sight of him is good for the evil-doer.

For a start I would recommend a detention barrack to be built or reappropriated in some big naval or military center, and placed under an officer whose tact and patience are beyond question; whose heart is in the matter of reform, and whose head is full of the information so gladly supplied by those who know the game.

The first step might be looked upon as experimental. "Provisional" regulations must be drafted, carefully considered and passed.

Sentences for offences against discipline *only* should be inflicted ranging from 28 days to 6 months.

Great attention must be paid to personal cleanliness, and "good order" in the "rooms." The food should be good, well served, and sufficient. These things act automatically and need no further explanation. They are the foundation on which a man's self-respect is reconstructed, and which, with the general treatment I have already described, produce a sane mind in a healthy body.

I have before me a letter dated 11th May, 1912, from an admiral who sat in committee on our military detention system at the commencement of 1909. He says: "Our detention system is, I consider, a great success."

I have also a report rendered to our Admiralty in October, 1907, by a naval officer, whose wide experience as governor of a British naval prison, and whose first impressions of a British *military* detention barrack, are of the greatest value.

This officer's grasp of the situation, and the splendid honesty with which he records, in simple words, his conversion, must carry conviction to the minds of all who read his remarks.

I have permission to quote him:

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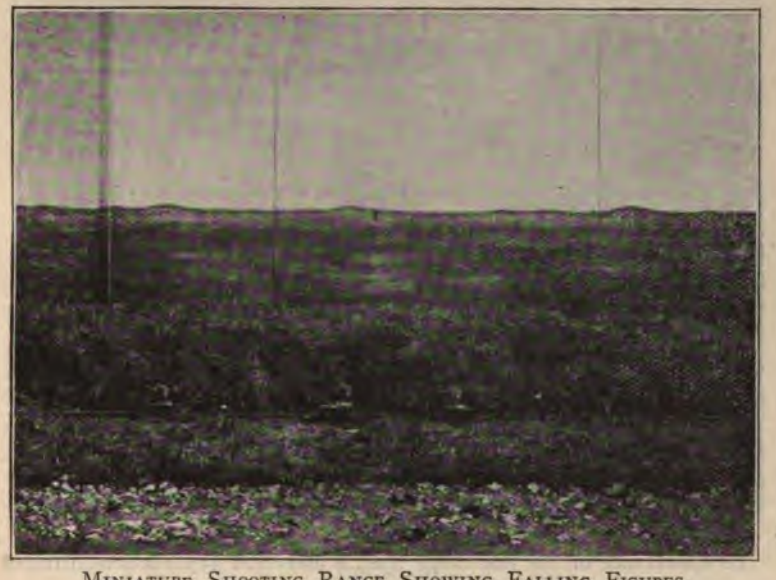
I am unable to form any independent opinion as to the suitability of the military system as a *deterrent from offences*, but the military reports seem amply conclusive in its favor.

But, as a *means of punishment for disciplinary offences*, I consider it far superior to the existing naval system, though I was strongly predisposed against it when I started from here. Any remarks on the two systems inevitably fall into a statement of strong and absolutely opposed contrasts; no comparisons are possible.



MINIATURE SHOOTING RANGE SHOWING FALLING FIGURES.

The military system aims at "removing the stigma of imprisonment" from men in the army, and is carried out in all its details to the full logical extreme.

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Prison terms are avoided. The "prison" is a "detention barrack," the "governor" is the "commandant," "warders" are "sergeants" or "the staff," "prisoners" are spoken of as "men," "cells" are "rooms," "imprisonment" is "detention," and the men are known and addressed by name, not by their numbers; they also retain their connection with their corps or regiments, and are throughout under the Army Discipline Act. Thus, the term "imprisonment," associated in most minds with criminals, of even the worst kind, is not associated with respectable men, who are under punishment for mere disciplinary offences, not disgraceful crimes.

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The men are received in their regular uniforms, and in heavy marching order with their arms, which are in use constantly during their "detention." This avoids the public scandal of men in H. M. service being seen in the streets and trains handcuffed, and in what is evidently a prison dress, and sometimes arriving here at the same time as batches of convicts chained together, which is degrading to the men, and a slur on the service. This also avoids the expense of prison clothing, as none such is worn.

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No useless labor is done, all the physical fatigue, which shot drill aims at as a part of the punishment, is inflicted much more efficiently by squad

FIRST-CLASS TARGET IN MINIATURE.

Its appearance on the real range from a measured 35 yards demonstrated at 200 to 600 yards, inclusive, "all up."

and company drill, the men being kept on the move as long as it lasts; and by Swedish exercises in which they are thoroughly taxed in every kind of muscular exertion.

I saw men in a state of breathlessness and sweat which is never dreamed of in a naval prison, and those who had been under the system for a short time were "hard as nails," and able to double round the exercise ground for two miles at a stretch.

The men are gradually brought up to this under the observation of the medical officer.

The industrial employment is in "association" except in the evenings in their "rooms" after supper. This is a great advantage, for the men are thus kept under observation all the time they are at work, and cannot

"slack" off, so that the different abilities of men to do such work is fairly provided for, in a much more equitable way than by allotting fixed tasks, which, while fully occupying an old hand, shall not be unjustly severe on the beginner.

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The loss of an hour daily for exercise, as in a naval prison, is avoided. Instead of a mere walk round a yard they have a vigorous "rouse about," and instructive set of drills, which must be more beneficial to the men, and, therefore, to their efficiency for duty on discharge, than mere walking,

BATTLE-PRACTICE TARGET FOR VISUAL TRAINING, FIRE CONTROL AND DISCIPLINE.

Range 25 yards, figures to scale representing 150 to 1500 yards. The figures move at will and are worked by signal from behind.

and sedentary work in cells, out of which many men only come for 1½ hours daily for weeks.

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I was informed by my chief warder, some little time ago, when discussing with him the employment of some men just received from Malta Military Prison, that many had told him that they preferred the "quiet, sit in your cell" life of a naval prison, to the hustle of Corradino.

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In addition to the infantry drills the men went through fairly stiff obstacle races, and the emulation evinced ensured a fatigue which very few men would willingly incur, and fewer still voluntarily often repeat.

Semaphore and Morse were being taught, and the circumstances compelled the men to learn them which very few men of that class would voluntarily take the trouble to do. They were thus made more efficient for their service, and, considering that naval men are, as a rule, superior to army recruits, this appeal to their intelligence seems to me to be most desirable.

Musketry and Morris tube practice are taught with good results. These and the Dotter would be of great advantage, as privileged instruction, to our well-behaved men.

The instructors are smart, non-commissioned officers. If gunnery instructors were sent to our prisons for their last three or four years, a great deal might be done, and the additional cost to the service to provide the extra qualified men would be more than met by the saving of warder's pay, clothing, and continuous service pensions. But the selection of these petty officers would have to be most carefully made.

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I think that many men, especially the younger ones, are disgusted with the service, and get into trouble through being harrassed by their petty officers, who are impatient of their ignorance, expect them to know more than they do, and won't take the trouble to teach them. If I am right, such men going through a course under the contemplated system would return to their ships with confidence in themselves, and ability to do their work better, and so would no longer be a source of irritation to their petty officers.

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I don't think it need be feared that, with the increase of improving accommodation the discipline of the service would suffer through the punishment not being penal enough. After all the men are not criminals, and sometimes were not really the ones most in fault (though this could not be pleaded except as I am now submitting it), they are, as a lot, good-hearted, straight men; and I have found with even the worst (one or two excepted) that they have responded quite respectfully to any individual appeal or show of personal interest. Quite recently when a man was brought before me for the 6th or 7th time in a short interval, for persistent laziness, I said to him, "I have tried every punishment on the list, now I'll try one which is not mentioned, and see how you take it, I let you off and give you nothing this time." He said most respectfully, "Then, sir, you'll not see me up again." And I did not. He gave me no more trouble during his remaining month or six weeks.*

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It is worth mentioning that in their letters home, which I have to read, the men are at some pains to impress upon their friends that this is not a civil prison, and they point out the difference between crimes and offences. Let us get rid of all criminals.

To utilize the reputation which the army system has begun to get (and to strengthen it by adopting it), that men in the service places of confinement are not on the same footing as common criminals, I would like

* This very seldom fails.—G. H.

to see the army nomenclature adopted, and as far as practicable the procedure also.

The military system is found to give excellent results with men whose average period of confinement is less than 30 days. I should expect better results with us, for I find that during the last 6 years the average period of confinement has been (approximately) more than 60 days in this prison.

The question of material.

To sum up, the value of saving good material has, I trust, been made plain. The raw article is, on the whole, splendid. It improves or deteriorates according to circumstances.

Every man has some good, and most have some bad points. Foster the former, correct the latter, and your net result *must* be good, the gaps in your ranks few, and your morale, efficiency, "form," and general tone, wholesome, clean and satisfactory.

STATEMENT SHOWING THE NUMBER OF SENTENCES SERVED DURING THE YEAR IN DETENTION BARRACKS BY INDIVIDUAL SOLDIERS.

	Number of times.				Total.
	Once.	Twice.	Three.	Four and over.	
Aldershot	1,728	183	43	14	1,968
Colchester	360	45	12	4	421
Devonport	284	40	7	4	335
Gosport	634	54	21	4	713
York	410	37	6	2	455
Cork	330	40	8	..	383
Dublin	655	46	11	2	714
Stirling	145	14	1	..	160
Bermuda	23	5	..	..	28
Cairo	149	13	2	3	167
Gibraltar	227	15	5	4	251
Hong Kong	79	12	5	2	98
Jamaica	44	6	1	..	51
Kandy	12	2	1	..	15
Malta	287	75	20	42	424
Mauritius	40	...	..	..	40
Pretoria	276	56	16	8	356
Seirra Leone	47	3	3	1	54
Singapore	29	4	..	..	33
Wynberg	61	10	3	1	75
Chelsea	214	24	3	1	242
Pembroke Dock	59	9	2	..	70
Shorncliffe	284	25	3	1	313
Woolwich	152	14	6	..	172
Jersey	22	2	..	..	24
Khartoum	21	...	..	..	21
Total	6,572	734	179	98	7,583

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THE U. S. NAVAL ACADEMY.

AN UNDERGRADUATE'S POINT OF VIEW.

By MIDSHIPMAN ERNEST G. SMALL, U. S. N. A., Class of 1912.

It was with some degree of trepidation that I approached the subject of the Naval Academy from an undergraduate's point of view. Having been steeped in a naval atmosphere for four years, I have absorbed a respect for authority which has made me hesitate to add my opinions on this subject, to those advanced by officers much my senior. There was also the fear, closely akin to the Chinese fear of "losing face," that in a few months after graduation, I should find my judgments reversed by virtue of a sounder knowledge of what is required of an officer. However, I have persisted in my attempt, and I present my impressions of the Academy system, its tendencies, and also some suggestions that have occurred to me. The whole paper will be, of necessity, of a rambling nature, and will be only what it pretends to be, an undergraduate's views.

In considering the scholastic side of the Naval Academy, the system of instruction combines the Oxford system of education and the American university system. Briefly, the Oxford idea is to leave the undergraduate largely to his own resources for three years, and then to set an examination for him, by which he stands or falls. This plan of education exercises the judgment and discernment of the student to a high degree, for it is obvious by the very nature of the case, that the examination must concern itself with practical knowledge, broad principles, and not with a mass of trivial detail. The American university system makes each half year complete in itself. The American student finishes his freshman Latin, his analytic geometry, or what not; forgets it; and seeks for new worlds to conquer. I repeat the Naval Academy system combines these two systems. The midshipman's half

year is complete in itself, but he must take a semi-annual and annual examination in every subject; and these examinations, unlike an Oxford examination, in most cases, do not concern themselves with broad principles, but often do ask for very minute knowledge. The net result is that all but exceptional midshipmen suffer from a mass of undigested knowledge. Under the scheme of exemptions formerly in operation whereby a midshipman having a mark of a 3.00 or over (out of a possible 4.00) for the term, was exempt from the examination, the majority solved the problem in the most economical way. Since it was easier to get a 3.00 by making each month complete in itself, they made the month the objective, and avoided the examination with its attendant work and worry. At the present time the midshipmen are floundering, hoping to pull through somehow. Personally, I believe that the Oxford idea is good, and that an examination is a valuable index to "present character and true worth," to borrow a familiar phrase; for it is not what we have learned an hour ago that counts so much as our ability to produce our knowledge six months hence. An examination is simply a concrete application of the principle of "by their fruits ye shall know them," a principle as equally applicable to things mundane, as to things religious. To make the examination effective, to conserve its true spirit, care must be exercised by those setting it to see that it is fair, broad in its scope, and not a gigantic feat of memory.

This congestion, this cramming process, is largely the result of the attempt to meet the increasing requirements of the naval profession in the same time as was required forty or fifty years ago, when steam was in its infancy, and fire control unborn. The results are bad. Specially prepared text books in "tabloid" form are issued to midshipmen, and they are required to accept fact after fact, because "the book says so." The valuable training given by modern education in weighing evidence is missed altogether, and the student develops a slavish adulation for the book.

There is one benefit. Early in his course, a midshipman learns the value of "bluff." The first time he is called upon to recite on a subject he knows nothing about, he asks to be excused. Presto! He gets a maximum of a 2.00 for his second subject. The next time he gets a subject he knows nothing about, he presents some product of his commonsense that often times brings him a 2.50.

I have known a section after a recitation to remonstrate in no uncertain manner with a member who had refused a subject. This training is valuable in that it instills a little of the " Message to Garcia " spirit, so necessary in a military organization.

As an illustration of this training and its effect, it is amusing to note the discussions that often arise among midshipmen as to the value of a Naval Academy education for engineering professions. The majority seem to think that lucrative employment is bound to fall to the lot of any graduate on the mere mention of the name of his alma mater. Little do they consider the exacting requirements of modern engineering, the long apprenticeship, and the high degree of specialization required. All this goes for nothing. The spirit of do what you are told, for it can be done, is so inbred, that it completely overshadows the difficulties. Judging by the records of Academy graduates in civil life, the contention of the undergraduate is probably true. The graduate would succeed, because he simply would not fail.

Crowding is not only felt at the Naval Academy, but elsewhere. The alternate work a week, and study a week plan, covering a course of six years in the engineering school of the University of Cincinnati, and the requirement of a bachelor's degree for admission into the engineering schools of Columbia University, are but signs of the times. The increase of technical knowledge and the glut on the market of professional labor are perhaps the determining factors. It has been proposed to meet this requirement of more preparation, at the Naval Academy, by a five years' course of instruction. The objection to this plan is, that it postpones for a year the advent to sea, the only place, so many authorities tell us, where a man-of-warsman can really learn his profession. This objection might be overruled and the five years course established, if there were no other remedies at hand. But are there not other remedies?

It is a fact that the requirements for entrance to the Naval Academy, when compared with those of other scientific schools, are low. Most scientific schools of the caliber of the Massachusetts Institute of Technology, Stevens, and the University of Wisconsin, require in addition to the Naval Academy requirements, two foreign languages, physics, chemistry, solid geometry, plane trigonometry, a more extended knowledge of algebra, and a working acquaintance with mechanical drawing. Why should not

the Naval Academy demand as much? If the Academy is designed to furnish an education for youths from the entire country, from regions where educational advantages must of necessity be few, much in the same spirit as our public schools seem to attempt to train every child as a potential president, of course the requirements can not be raised; but if the fact is recognized that with the increased density of population and its consequent keener competition in the professions, a larger field is open, there is no reason in my mind why advantage should not be taken of this condition to raise the requirements. Paradoxical as it may seem, I do not belive the number of candidates for appointment would be cut down, for men like to strive in proportion to the hardness of the struggle. It may be urged against this scheme that the age of admission to other scientific schools is higher than that required for the Academy. I can speak from but a limited knowledge on this point. The Academy age for admission is from sixteen years to twenty years. The authorities of the Massachusetts Institute of Technology, an admittedly superior institution of its kind, recommend that freshmen be at least seventeen years of age. Briefly, raising the entrance requirements commends itself to me as an intensive cultivation of resources already at hand.

The second remedy I would propose is to put off the fifth year until the graduate has had sea experience. Let the four years be as broad in its course of study as possible. Let him go to sea for two or three years. There will he find himself as truly as did that ship of Kipling's. At the end of this period, having tested his capabilities and found his specialty, let him take his courses in steam, electricity, ordnance, international law, or in whatever field his ability lies. Does not the present system tend to turn out specialists in all branches, regardless of the limited capacity of the human machine? Is it not true that every new advance in the naval profession has meant an increase in the Academic working pressure to the end that the graduate be familiar with every branch of a profession which in a way is more than an epitome of all others?

In regard to the teaching by practical work—everybody recognizes that the laboratory method of teaching is essentially a correct method, and that it has come to stay. I shall not attempt an analysis of this feature at the Academy, but be content with a few random impressions. It seems to me that midshipmen are shown

how a thing is done, but are given little opportunity actually to do it. To illustrate, on a practice cruise our midshipman watches a fireman clean fires, and at the end of the week writes in his notebook a very glib account of the manner of cleaning fires. But he misses something in not actually cleaning the fires himself. The important factors of heat, blistered hands, the knack of turning the tools, he misses altogether in his book account; and it cannot be said of him with certainty that two years later he will be able to grab a shovel from an inefficient fireman, and show him how fires should be spread. I suggest putting him on the fires, seeing that he actually oils during his watch below, putting him in the gunner's gang, letting him crawl through the roller path, to the end that he gain a practical familiarity with the duties of keeping a turret in shape, and then as a check, let him write a *short,* concise account of the duties done. The secret of efficiency in practical work is to give him more responsibility, and to see that he measures up to the standard that responsibility demands.

The matter of discipline has, I suppose, brought out more discussion than any other feature of military organization. Everyone seems to have his own views on the subject. I am no exception. The system in vogue at present at the Naval Academy is the time honored one, a multitude of regulations to be kept, with punishment sharp and certain for breaking them. This arrangement certainly produces a valuable training. The habit of seeing that one's locker door is closed whenever one is absent from the room (to mention just one of the many requirements that must be lived up to) is excellent in that it fosters a habit of care. There are features, however, that might be eliminated, I think, with profit.

One of these features is the custom of placing a midshipman on the report when the proof of his wrong-doing is insufficient. Under the splendid code of honor that exists, the midshipman has but to make a written statement to the effect that he did not do the act charged, and the report is removed. Surely, it will be urged, there can be no objection to such a truly Arcadian arrangement. But, the fact is, midshipmen are not Arcadians. They are Anglo-Saxons with all the Saxon dislike for shouldering the burden of proof of their innocence. I have known numbers of cases in which midshipmen have taken their demerits for offenses of which they were not guilty, because they would not make a

written statement, an act which they considered equivalent to proving their innocence. Foolish? Perhaps.

Surely it is reasonable to ask that this condition be remedied, if for no other reason than that the sentiment it engenders is subversive of discipline. There is another reason calling for a change. The many opportunities given to persons in and out of the naval service to report midshipmen creates in the minds of the latter, if not a fear, an unwholesome respect for whoever ranks them. It is not inconceivable that in the after lives of some of them, there will come a time when they must perform a duty that will be very distasteful in its working out to some one who ranks them. The present scheme of things will hardly produce strength to meet such a crisis.

The remedy to me is simple. Change the system of reports to that system which obtains at sea. Let trivial reports go by the board, and above all, let there be a solid basis in fact for every report. By this means, there will not be a new order of things to be learned on going to sea. I have in mind a few words of advice in the "Hints to the Graduating Class" which illustrates my point exactly: "No captain is pleased to find a large number of men at 'the mast' each morning, and the officer who makes needless reports will hear from him. It is a sign of inexperience."

The transition at present from the strict and minute control of the Academy to the responsibility of an officer is a very sudden one, so sudden that it often overthrows the balance of the graduate. The effect of the change could be lessened by making the transition more gradual. Give the upper classmen more responsibility and more privileges. The privilege of leaving the city of Annapolis for a few hours, say Saturday afternoon and evening would be highly prized, would tend to greater content, and would result in higher efficiency. It may be urged that the privilege would be abused; but in the main I doubt it. Midshipmen are proud of their service and their uniform, and if the facts were plainly put to them, they would see that they were a credit to the service they represented while away. I can think of so many occasions in my four years when a few hours change of scene would have meant a great deal. It would have meant so much to me that I would have striven with might and main to earn the privilege if I had had the opportunity. This is a suggestion of what might

be done. Responsibility and privilege are powerful agencies in character building.

The athletics of the Academy are splendid, and one can take just pride in them. The evils of paid admissions are avoided, professionalism is unknown, and everybody takes part in athletics to a greater or less degree. The Brigade, while it watches the development of the first team with keen interest, and supports it in its contests as one man, does not leave sport to the first team alone. I doubt whether there is an institution in this country where the number of scrub and class teams is so proportionally great. Of the harmfulness of particular branches of sport, I have nothing to say. That is a matter for medical experts to decide. What I do wish to bring out are these: Competition with outside teams increases the interest in athletics for the rank and file. Athletic sport brings out qualities essential to military leadership, for the records of the past few years show man after man of whom it can be truly said, that athletics brought out all his qualities of leadership.

To sum up, there is a fruitful field awaiting development in the matter of raising the entrance requirements; the need is for a broader course with specialization later; practical work should be more practical; a more extended application of responsibility and privilege would bridge the chasm between undergraduate and graduate; and the existing evils of the present system of reporting should be changed.

In conclusion, I cannot help speaking of the sense of power and poise one feels one has attained as the result of one's training at the Naval Academy. Here I am bordering on things that one does not speak about. There are priceless possessions that one cherishes, but never mentions. After all, the four years have been good, not always pleasant, but well worth the struggle.

A Typical General Storekeeper's Force for a Capital Ship.

In the center the chief yeoman (or pay clerk) in direct charge, and a "make" yeoman in training. On the right, seated, the Title "X" storemen with the "X" ledger yeoman behind. On the left, the Title "B" storemen with the "B" stock yeoman. The storemen stand regular watch in their respective storerooms, and are equally from deck and engineer's ratings.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE SHIP'S GENERAL STOREKEEPER.

By PAYMASTER G. P. DYER, U. S. Navy.

Under this caption I propose to set down as simply as I can the details of the work of the general storekeeper of a cruising ship, with the ideas and methods which, in my opinion, should control such work. Many of these ideas and methods have never been reduced to writing, being heretofore embodied in tradition only.

My inspiration has been the general interest which a résumé of the modern aspects of this important branch of ship's work must have for the service, especially as such information is not readily accessible otherwise. I hope also, it may be of help specifically, to some of the many young officers destined to be assigned as paymasters of our vessels. These officers will have to confront situations involving principles and details which are new to them, but which have been worked out many times before. The experience of predecessors " at the work bench " ought not only to be of aid to follow, but to build upon and improve. There is much in our work which is yet susceptible of great development. The experience of the past or of the present cannot be considered the last word on the subject by any means.

The only qualification to which I lay claim, in setting down this experience, is as an old hand at ship's pay department work. In fourteen years' service, over eight have been spent as head of that department, on vessels of military type engaged in active cruising and operating under conditions of both peace and war. The rest of my service has been largely spent on duty directly connected with the fleet.

Fourteen years have seen many changes in the pay officer's work at sea. The general mess system has made its appearance and taken its place as an indispensable element of the ship's organization. The ship's store has come into being, and changed from

co-operative to government control. Methods in the issue of clothing, and in accounting for it, have been wholly changed. Office routine and accounts have been revolutionized. Finally the general storekeeping system afloat has been established, and bids fair to follow the general mess in being recognized as a necessary integral element of the ship's organization.

The modern cruising ship usually has but one pay officer. He is the head of the pay department, as the ship's department representing the Bureau of Supplies and Accounts is designated. As such he is the general storekeeper, commissary officer, officer in charge of sales stores, and disbursing officer of the vessel. The pay clerks and enlisted force allowed him to discharge these functions, constitute the pay division of the ship's company, over which he acts as divisional officer. The character of his duties thus indicated divides them into four categories. The general nature of these duties are quite clearly indicated by naming them alone, and it is the purpose of this article to take up only the duties of the pay officer in his work as the ship's general storekeeper.

As general storekeeper the pay officer is charged with the maintenance on board of a proper stock of all supplies, Title X, and of the proper outfit of equipage, Title B. All equipage in store, that is not in active use about the ship, is in his direct care and custody. Equipage in use is accounted for through information furnished him by the heads of the ship's departments representing the various Bureaus which are using it. In this way, as far as the Bureau system will permit, equipage and supplies are treated alike, the accounts therefor being kept under one officer, and made the subject of one set of returns.

The only titles with which the ship's pay officer has to do in his capacity as general storekeeper are Titles B and X.[1] All public property on board, with the exception of provisions, clothing, medical and marines' stores, and coal and ammunition, is included under one or the other of these titles. The articles excepted are accounted for, either by him or by other officers in special manner, mainly under Title Y.

NOTE.—The writer wishes to note, while the methods and forms described under this section accord with existing orders and regulations, they are too recent to have been formally approved beyond the Pacific Fleet. Except when specifically advanced as theory, everyone here recommended,

[1] For titles of articles see General Orders 78, 79, 121, and Bu. S. & A.'s Instructions file nos. 112568, 112570.

however, has been tried by him and found practicable. Ideas have been adopted from many sources. In particular, those of Pay Inspector T. H. Hicks, U. S. N., have been numerous and valuable. The full co-operation of the officers of the *Colorado* and the enthusiastic interest and work of the enlisted men of her general storekeeping force have been of the greatest assistance in developing the system.

Title B covers the outfit of the ship, the movable equipage. This is furnished by the bureaus on her commission, and is maintained by them. Supplies necessary for her up-keep, other than this permanent outfit, are put on board under Title X, and drawn and paid for as needed by the officers representing the bureaus from the sums allotted them for such expenditures by the bureaus. The official distinction between equipage and supplies is an artificial one. Equipage is that part of the stores used on board which the bureaus wish accounted for after issue. They do not permit equipage to be expended except after survey, *i. e.*, an impartial investigation by disinterested officers as to the reason and responsibility for damage or loss. Supplies are those items which for various causes the Bureaus do not wish to follow into use, and which, therefore, are expended on issue and without survey. This distinction in practice is made closely to correspond to the natural difference between items which do not immediately merge into others or disappear in use, and those which are consumable, that is, do disappear when so treated. Illustration will make this clearer. Furniture, flags, tools, band instruments, etc., are equipage, the disappearance of which must be investigated and accounted for. Paints, packings, nails, cleaning paste, are supplies which lose their identity in the item to which applied, and thereafter are not considered separately from it. This distinction between equipage and supplies creates differences in their treatment. Since equipage is followed into use, it must be accounted for under the different bureaus until finally worn out. Supplies being expended as drawn have merely to be considered while held in the Naval Supply Account, with provision that proper re-imbursement to it be made on issue. The result is, all supplies on the general storekeeper's books are "in store" under one account. while equipage may be either "in store" or "in use," and is carried with a separate account for each bureau.

These differences, while they naturally make advisable consideration of each title separately, do not affect the fundamental prin-

ciples governing the procurement, custody, and issue of stores for the service ashore or afloat. These principles may be embodied in certain axioms which should guide all general storekeepers, particularly those afloat, where space and conveniences for the conduct of their business is limited. Let us give emphasis to these axioms by listing them.

SHIP STOREKEEPING AXIOMS.

Don't run out of any item of stock except by design. Conversely, don't overstock.

Don't let stock get hidden away. Stock "out of sight is out of mind."

Don't let stock deteriorate. Every moment spent in furbishing and making it attractive to issue saves hours of criticism and explanation later.

Don't make it hard for authorized persons to get stores. They are kept on board for use and should be as accessible as possible.

Don't employ any methods save those which will minimize errors in recording issues and receipts.

As with all axioms, the truths these express seem trite. But unless they are kept steadily in mind and applied to every situation which presents itself, the storekeeper will often find himself far afield.

SUPPLIES. TITLE X.

STOREROOMS.

The application of these axioms, for instance, meets us at the first turn we take into our subject. They result in certain fundamental necessities in the location and equipment of storerooms. These also may be tabulated into: (a) *concentration* of stores on hand to the limit possible; (b) *visibility* of all stock in storerooms; (c) ready *accessibility* by all departments.

Concentration of storerooms in the same vicinity is obviously necessary from several points of view. One with any experience with stores realizes that a correct inventory is exceedingly difficult when they are scattered. Keeping track of issues, or of excess or depletion of stock, is difficult also. Nor are scattered

stores, not under constant observation, likely to receive proper care.

The ideal arrangement to be approximated as nearly as possible in practice, is for all ship's storerooms to be interconnecting with B in one series, X in another, and with a common center for the issue (and receipt) of stores. In the design of the vessel, assignments, to more important military functions, usually prohibit the location of *all* storerooms together. In this case the best division provides for all those for supplies, together, leaving equipage to be similarly concentrated elsewhere. On the large, older ships, Title X usually can be concentrated in an after set of compartments, and Title B in one of the forward sets. Where it has not already been done, even this arrangement will involve considerable reassignment of spaces and work in shifting stores; but the results amply repay the labor.

EXCEPTIONS TO CONCENTRATION.—By reason of special characteristics some supplies are not subject to concentration in storerooms which can contain the rest of the stock. These are: inflammables, which must be kept on upper deck; lumber, bar metals, and piping, the length of which sometimes limits the choice of place to stow; heavy cordage and wire also, on account of its bulk and weight; lubricating oil for the main engines, usually carried in too great bulk to stow with other stores; and paints and oils, which usually have a separate locker specially fitted, provided for them.

The concentration of stores brings with it the possibility of the use of one set of storemen, each of whom is competent to answer any call, and who by standing regular watch can keep the storerooms open for business night or day. This is an important consideration as will be seen later; so important that if X and B have to be divided on a capital ship, it is worth while to have a gang of storemen detailed for each set of storerooms.

With storeroom space concentrated, it is well to have each set arranged with but one entrance to give on a small clear deck space available for use by customers while waiting to be supplied, and as a receiving floor to hold items coming into store, pending inspection and identification with invoices and stock numbers. The station of the storeman on watch is at this entrance, and all customers should be prohibited from going into other storerooms

unaccompanied by him. This is found advisable to keep the stock from being handled and disarranged.

Visibility of supplies in storerooms, when concentrated, should govern their interior arrangement. Many ideas of the past with regard to storeroom fittings must be disregarded. Storemen used frequently to cover stock as much as possible in cupboards, drawers, deep shelves, or out of the way storerooms, in order to stand a good inspection on the strength of paint work and shellac. The slightest personal experience in keeping stores is convincing that fewer mistakes in reporting stock "all gone," and omissions in the proper care of stock occur, when it is constantly in sight. These lead to the revision of usual fittings as follows:

MAIN STOREROOMS FOR TITLE X, as far as *general characteristics* are concerned, should be as large in dimensions as the structure of the ship will permit. Unnecessary bulkheads, either of metal or wire mesh, should be banished. A straight lead with as large a hatch as possible should be provided from the open air to the receiving floor to facilitate taking stores aboard. This is usually a rush operation, with comparatively large quantities of stores to be handled. Connecting doors should be as large as standard fittings allow. Decks should be of bare metal. Grating or floor boards are unnecessary and hard to keep clean. Except in the receiving room, shelving should all be open from floor to the deck above, and should extend around all walls. Little floor space should be free. Most of it should be taken up with shelving arranged in stacks with narrow aisles between. Main passageways should, of course, be kept clear. Storerooms should be thoroughly lighted, so that there shall be no dark corners whatever. To accomplish this, small lights should be placed about and under the shelves. Switches at the entrance to storerooms will enable lights to be turned off when the room is not in use.

Special fittings for Title "X" storerooms, as far as developed on one capital ship with its supplies concentrated, may be enumerated here. A total of 700 linear feet of shelving is enough, if it averages 20 inches deep, with 12 to 18 inches clearance. Twenty-seven inches between stacks is as narrow as convenient. Suitable pockets for small articles should be made in movable units, with the partitions between them removable, so as to vary the size of the pockets to suit the stock on hand.

For electric bulbs, drawers, with false bottoms perforated to size of bulb. For glass and thin sheet metal, one rack with 20

VIEWS IN THE TITLE "X" STOREROOMS.
Note the open character of all shelving, the small lamps under the shelves, the battens to secure for sea, and the stock tags.

pockets. A glass cutting shelf, 44 x 44 inches should be fitted near the glass rack, so arranged as to slide back out of the way when

not in use. For heavy sheet metal, one rack 19 inches between uprights four feet apart. For bar metals and tubing, four racks with 24 divisions, 10 x 12 inches by 20 feet. The divisions should have intermediate supports about every five feet. For lumber, two racks fitted with racking and with outside measure 6 x 6 x 10 feet. It is usually necessary to locate these racks on one of the upper decks; in this case they should be inclosed in a locker which can be secured to keep out unauthorized persons.

A small desk should be located in the receiving room where the storeman keeps watch. A six-compartment metal file case handy to the desk is convenient. These fixtures can be used for the set of standard specifications which should be kept in the storeroom, or for other papers needed.

A telephone to ship's central should be installed at the storeman's desk. Throughout the storerooms small supports should be fitted to shelves to permit storeman conveniently to make his entries on chits at the place and time items are issued.

A most effective method of lighting up stock is by placing five candle power lamps at short distances apart on the under side of the shelves. These lamps should be screened from the eye. This requires a number of lamps, but they are of small power and are not lit, except as necessary. When turned on, however, no part of the stock escapes obesrvation in obscurity. This is a most important item in the fitting of the storerooms.

The section of the storerooms devoted to non-inflammables, amongst the paints and oils, should be fitted with overboard drain if possible, and have deep heavy racks for about 80 5-gallon tins, 60 10-gallon drums, and 80 100-pound kegs, as well as clear space to pile about 210 cases of engine oil (containing 2 5-gallon tins) dimensions, 21 x 16 x 11½ inches over all, or an equal amount in barrels. (Bu. S. & A., letter 104206, April 3, 1912.) Limitations of space will ordinarily require that this oil be kept in the engine compartment on custody receipt. There should also be about 80 linear feet of shelving 10 inches deep, and with 12 inches clearance, to take 1- and 3-pound cans of mixed colored paints, etc.

Such special equipment as necessary to aid in speed and accuracy in the issue and care of stores should be installed, such as dial spring scales, at convenient points, and small power driven metal saw near the metal rack. An electric hand buffer for keeping metal bright should be furnished also. Lockers should be provided

with space for each of four storemen to keep a change of clothes, so that in doing dirty work he may shift to dungarees.

RESERVE STOCK STOREROOMS.—Except in an ideal arrangement, all stock (other than the items whose characteristics forbid concentration), cannot be carried in the main series of storerooms. This will require subsidiary compartments to act as feeders. These in general should conform in fittings to the foregoing description.

The locker for inflammables, paints, and oils required kept on deck, should be fitted for bulk stowage of five-gallon tins and ten-gallon drums, should have an overboard drain, and specially strong compartment for alcohol, which should be fitted not only with an ordinary lock for the storemen, but with a combination lock, which can be opened only by the master-at-arms, or other person authorized to draw alcohol for the ship's use. All lockers exposed to the open air should have inside locks rather than padlocks, as the latter deteriorate rapidly with weather, washing down decks, and scrubbing paint work. I am not in favor of the use of tanks for inflammables. They are hard to keep clean, and waste room where space is valuable. A tank with but an inch of liquid in the bottom is lost, as far as the rest of its stowage is concerned.

Accessibility to stores is, after all, the prime object of concentrating them and making them visible, as indeed it is the main reason for their presence on board. The location and fittings of storerooms, as well as the methods in arrangement of stock, consideration of which follows, should all converge to make it as easily and certainly accessible as practicable, for all having to draw upon it. The telephone connecting with all parts of the ship through central saves much time. Where storerooms are deeplying, a routine for the delivery of stores to the points needed will also help. A mechanical means for delivery, such as a small hand lift to a central point of the decks above might be advisable.

SUPPLIES (TITLE X).

STOCK.

The application of our fundamental principles to the receipt, care, and issue of Title X stock afloat produces interesting results. Having storerooms in as satisfactory condition as pos-

sible as far as location, arrangement and fittings are concerned, the general storekeeper can next turn his attention to the stores themselves. His consideration of this subject may be divided into having these: (a) most concentrated; (b) most accessible! (c) maintained in proper quantities; (d) in proper condition; and (e) most accurately accounted for.

Concentration of stores within the limits of a storeroom is no less important than concentration of storerooms. All items of the same kind should be put together. One unacquainted with former conditions would be surprised at the way stores used to be scattered about a ship. Radical measures were needed to bring the separate bureau stocks of supplies together to conform to this simple and obvious idea.

The classification of all navy stores under 65 classes has been a great aid in arranging them afloat as well as ashore. The "Indexed Classification of Naval Stores and Material" is the official publication which lists alphabetically, and with remarkable completeness, the names of all items used in the service. It indicates for each whether it is B or X, and in which class it belongs. The division of classes is along natural lines; so that one soon learns the class numbers.

ARRANGEMENT BY CLASSES OF SUPPLIES in the storerooms is made convenient through the use of this classification. This arrangement splits the stock up into more intelligible and manageable units. The characteristics of some items prevent placing all the articles in one class together, but separating them should be the exception and not the rule. Such exceptions, however, are: Class 8, gasoline; Class 12, oars, boat-hooks, squilgee handles; Class 13, cotton waste, grate bars; Class 14, kerosene, engine oil; Class 21, heavy cordage; Class 22, heavy wire cable; Class 38, brooms; Class 39, lumber; Class 44, metal piping; Classes 46 and 48, bar metals and angles; Class 50, fire-brick; Class 52, inflammable paints; Class 65, fresh water. In most of these cases the reasons are obvious why the items cannot be put on the shelves or in the bins with others of the same class.

ARRANGEMENT ALPHABETICALLY, in each class should follow segregation by classes. This is done with the aid of a device, the importance of which from the standpoint of celerity and certainty of issues can scarcely be over estimated. This is the use of a stock number system. Each item in stock is given its special numeral

in a series of self-indexing numbers. The best series for this purpose is one similar to that used for standard specifications by the Bureau of Supplies and Accounts, in which the numbers indicate not only the class but the initial of each item. By its use, items in many classes can be so arranged that, knowing either the class number and name, or stock number only, any one article can be instantly found, even by a person unacquainted with the storeroom. Items in general follow in regular sequence of stock numbers. In the comparatively few instances pointed out above, or when considerations of increased visibility and accessibility cause slight breaks in this sequence, samples or tokens are placed in order, tagged with the needed information as to where the stock may be found.

A stock number system, such as just referred to, has the following characteristics and advantages: The first figures in any stock number are those of the class to which the item belongs, as shown by the Indexed Classification. Then follows the initial letter of the correct name of the item. Finally come the arbitrary number (representing its place alphabetically, or by size, etc., in series from one up) of the item amongst others of the same class and initial. Sometimes there are too many items of one class and initial to permit an interpolation, without changing the last figures of many stock numbers. This is so with screws, for instance. There may easily be 180 separate kinds of these on the shelves. If they ran from 42S1 to 42S186, and it were necessary to interpolate a new item in the first ten of the numbers, it would mean changing the 160 odd stock numbers after the one inserted. This condition may be avoided without making the number system too complex, by adding distinctive letters after the initial letter. In the comparatively few cases required, this will effect a further sub-division of the class, so that the final series of numbers will seldom run up to more than thirty. Thus, interpolation need never be difficult to make, either in ledgers or arrangement of stock. To illustrate: 5B5 is bunting, white, 19″ ; 12H23, handles, squilgee; 15W19, wire lampcord; 33P13, packing, flax, square, ⅞″; 42S1, sockets, for table legs; 42SMR10, screws, machine, round head, brass, ½″, .011; 65W1, water, fresh.

The advantages of this system of numbering are: (a) it identifies items with certainty for all using it, and avoids the errors and confusion arising through the use of names; (b) it provides

means for interpolating items in the number system in place by class and initial; (c) it indicates the class and name to every one in the storeroom force; (d) it permits ready arrangement by storemen of items by class and number, without reference to ledger; (e) it helps to index the stock in storeroom as well as on the ledger.

Accessibility of stock as a term embraces all that relates to making stores as easily obtainable as possible by those needing them. To those who may be inclined to make their stock system so complex as partially to nullify its object, which is simplicity in issue, it cannot be too often reiterated that stores exist on board for issue, and for no other reason. The maximum of concentration in locality serves accessibility in reducing uncertainty where to go on the part of those needing stores, and *in* saving time after getting there. This doctrine has been carried so far already, on one ship at least, as to provide for the delivery of stores at the point of use rather than in the storeroom. On that vessel a delivery service, using the telephone and the legs of unimportant men to save time of important ones, is in full operation. The telephone connection with all parts of the ship makes intercourse easy as to stock. The storeroom, open night and day for business, breeds confidence on the part of all concerned that there will be no hitch in getting stores as they want them. This last is of such practical value that storerooms should not be permitted closed at any time, except by the explicit permission of the general storekeeper.

It should now be apparent why such pains should be taken with the arrangement of stock, and with providing means so that any storeman on watch will be able to lay his hand on any item with the least possible difficulty and loss of time. Some systematic arrangement is essential. The most obvious method is to have the stores arranged by classes, and alphabetically in each class, as described under "Concentration." In this order, all items should be represented by a part, if not all, of the quantity in store on the shelves. Where the whole stock of any article cannot find place in the main storeroom, the portion outside should be considered and called "reserve stock," and the compartments containing them, "reserve stock storerooms." These reserve stocks should be used as feeders to the shelves in the main storeroom, otherwise a waste of the time of both customer and storeman will occur in

leaving the main storeroom to go perhaps to a distant part of the ship. Where even a part of the supply of an item cannot find place on the shelves, a sample with stock tag should be placed in regular order in the main storeroom stock, so that at least any question as to stock number, location, identity or suitability of the item wanted can be settled before going elsewhere for it. If, as in the case of inflammables, even a sample is not permitted in the storeroom, a token with a tag bearing its stock number and location should be in proper place.

To those unacquainted with present navy conditions, these provisions may seem a theoretical and even absurd refinement in stockkeeping. I can assure such from actual experience that, aside from the desire to perfect the system, an immediate practical consideration exists where stores are concentrated so that all departments have to be served from a common source. The ordinary busy day on a large ship requires every device to promote ease and certainty of issue. Unless all such are provided, the storemen, being human, will make errors and let things go. It is bad enough to have to say of an item, "all out of it," as must be done once in a while, but many times worse to say it when the stock is on board, but in a place unknown to the storemen. This will happen frequently, unless all the sign posts are up. I go so far as to mark on the edge of the shelves where the stock *ought to be,* as well as tag each item of stock, and I think it pays. For example, with items 12-D-1 to 12-D-7 (various types of dogs for water-tight doors and hatches), besides having a typical dog of each kind tagged with its proper number, the shelf bearing them is marked with the legend, "12D1-12D7." For any reason should it be necessary to stow 12D8 elsewhere in the main storeroom, the shelf proclaims "12D8, upper platform, forward port." If 12-D-8 must be kept in reserve stock storeroom, and is therefore not immediately accessible, a sample with a tag exhibits the item in its proper order, and reiterates the direction of the shelf as to the whereabouts of the main supply.

Maintenance of stock involves the axioms, "Don't run out of stock," and "Don't overstock." The allowance lists of the various departments of items in Title X, inherited from the former system, are only approximate guides. These lists were originally compiled in Washington. They fixed unvarying and rigid limits to the quantity of each item which could be consumed

by the ship during the period of allowance. Such allowances could not be expected to fit various conditions in cruising, age of ship or character of heads of departments. The inevitable deviation from allowances were taken care of through supply under "in excess" requisitions. On the other hand, excesses in allowance were rarely reported. The tendency therefore was constantly to increase the number of items in the allowance, and to accumulate unused stocks of unnecessary items.

The present system is much more practical and flexible. The department fixes an allotment to cover the quarterly expenditures of each department on board each vessel. Any stores named in the old allowance lists *in any quantity* may be drawn and used by them during the quarter up to the value of these allotments. This provides for the variations in the ship's requirements, while attaining the department's object of supervising and limiting her expenses. Extra demands are covered by a request for addition to the current allotments, this corresponding to the "in excess" requisition of former times. Incentive to economy is furnished by the publication, from time to time, of the comparative tables of the cost under Title X of the ships of the fleet, grouped by types to make the comparison more conspicuous.

From this it will be seen the past issues of any item of supplies on a ship furnish a better guide in maintaining stock than allowance lists, especially if the former are corrected by information as to any contemplated changes in policy or material, obtained from the ship's departments.

In no part of his work with Title X is more delicate judgment required of the general storekeeper than in this. Therefore, he should make it a practice not only to note, but to scrutinize every item of each requisition submitted for his signature. In addition, when getting ready for cruise, he should make sure that the stock is gone over, item by item, for the purpose of preparing requisitions for sea stores. In ordinary times, every precaution should be taken to have the alarm sounded when the "low limit" of stock on hand is reached in any item. Every stock tag should have this "low limit" on it, so that the storeman, making the issue may see it and compare it with the quantity left on the shelf. Every stock ledger card should be similarly marked. In the one case, the storeman notes the need and starts the routine replenishment by sending in a "Storeman's Request for Stock" (see

Form 1 following) to the general storekeeper's office, and in the second, the office itself notes the need and initiates the requisition in case the storeman has overlooked it. In addition, the general storekeeper himself should constantly select for inventory, at random, items which are much used, to see whether the proper action has been taken. Often with all these precautions he will find the storeroom caught occasionally with none of a needed item in stock. Then his only recourse is to a quick transfer from the supply ship, or from other vessels in the fleet with stock to spare; or finally to an open purchase before the need becomes too acute.

On the other hand, to be efficient, stock must not be kept in too great quantities, "to play safe." Otherwise the storerooms, which can never be expected on shipboard to be entirely adequate in size, will be congested with a confusing quantity of slowly deteriorating

Form 1

Date..... No.....

STOREMEN'S MEMO. REQUEST FOR STOCK

Quantity		Article	Stock No.
Required	On Hand		

material. The important bearing of concentration and accessibility on this branch of the subject may be easily seen. The more stock is subject to daily picking over, the more likely its depletion or undue accumulation is to attract attention. But with all precautions, the only rule which can be followed with any success in the maintenance of stock is that of eternal vigilance.

Custody of stock from the general storekeeper's standpoint, means all that pertains to the care and condition of stock while "in store." This is a subject still in early development, as far as ships are concerned. Under the former system, the storemen only too often gave practically no care whatever to stores. When received, they were frequently bundled into drawers, or cupboards, or remote stow-holes, and left to themselves till brought forth for use. or turned in when the ship went out of commission. Surveys were common of material which had never

been used. Responsibility was difficult to locate, because usually the discovery of the damage or loss was much belated. Stores accumulated in odd corners, forgotten. In one case the general storekeeper on taking inventory on a large vessel, reported finding enough slate color paint on board to completely repaint the ship outside more than twenty times.

Numerous like instances could be cited, but this is enough to make manifest the aid given concentration, visibility, and easy access to stock in questions of custody. In plain view, in an orderly storeroom, stock can scarcely deteriorate without being conspicuous. Bars with verdigris, cans which leak, the ravages of moths or rats, all become plain. Perhaps the device of lighting every dark corner of shelves has most effect automatically on the care of stock. With well lit shelves, the storeman will have good looking stock on them.

Experience has proved, apparently, that it does not require technical experts drawn from other departments to take care of items in store, particularly Title X. It is well to call their specialists from time to time to look over stock and make suggestions towards improving its condition, but my experience is that, in general, better results are obtained by the use of men of lower rate for actual storeroom work, than petty officer specialists. The former, if he has a natural liking for the work, will put real interest and enthusiasm in it, while the latter is apt to be apathetic, especially under present conditions, when he sees no chance of promotion, but rather conceives himself as in a backwater of his business. I have seen not only the current work satisfactorily handled, but much real progress in rearrangement made by a Title X storeroom force, composed of two firemen, second class, and one ordinary seaman; at the same time the Title B storeroom keepers were one fireman, second class, and three ordinary seamen. The fact is, that except in very rare instances there is no magic in taking care of stores. With intelligence one can either see for himself, or easily find out, how it should be done. It should not be understood, however, that such men can be kept permanently interested or contented in these rates. There undoubtedly should be some means provided for the promotion of men who show themselves specially adapted to storeroom work, in order to keep them in it.

As hints in the custody of Title X stock, the following may be given. Bar metals should be painted on end with distinguishing colors, as indicated in Bureau Memoranda (p. 987), and instructions given to issue from unpainted ends of bars. Bright steel should be kept bright with electric hand burnishers. Barrels of cement, fire-clay, and light dusty articles should be kept in canvas bags made for the purpose. These items should be obtained from the storehouse in tins if possible. Rubber and rubber compounds should be in cardboard boxes, or wrapped in paper to exclude light (see Bureau Memoranda, p. 1930). Waste in bales, should be isolated in a small separate compartment, on account of the chances of spontaneous combustion, and, if received wet, should be given a chance to dry before stowing away. At sea, by routine, battens for shelves should be put in place in preparation for possible bad weather. In port, the battens should be removed the better to expose stock. A sufficient supply of paper bags, bottles, cardboard boxes, etc., most of which can be obtained from the canteen, should be kept in the storeroom for use in making issues. At all times items should be arranged on shelves as symmetrically as possible to permit storemen to gauge the quantity left on hand, at a glance, on making an issue.

Accurate accounting for issues and receipts. Primarily the accuracy of stock ledgers depends upon the storeman. Every aid should be given to make the storeman's work in this respect certain and easy. If he does not check receipts, or report issues correctly, the ledgers will soon cease to reflect actual conditions.

IN ISSUES OF SUPPLIES, the most usual causes of errors in making and getting them properly posted, arise in identifying what the chit calls for with what is actually issued on it.

Errors in nomenclature are commonest. If stock is dealt with by name only, confusion arises. Different persons will call the same article by different names. The difficulty first suggested the system of stock numbers already decided. A sample of every item in stock should be marked with its number. This is commonly a 1½ inch circular, metal-rimmed tag tied to one of the units on the shelves. In some cases, such as on plate metal, tin, or glass, pasters must be used. The storeman works by this number. All chits calling for items (Form 2 or 2a), and originating in the ship's department, are provided with a column for the storeman to enter stock numbers from these tags or pasters, as

the issues are made. As the ledger sheet bears the same number, any chance of error in posting through confusion in names is thus avoided. These stock number tags can be made to serve other purposes as apparent below.

Errors in confusion of units of issue are avoided by marking on the stock tag the proper unit as it appears on the ledger, " No.," for number; " ft.," for foot; " lb.," for pound; " doz.," for dozen,

Form a

U. S. S. COLORADO

Supply and Accounts Department .....191..

Issue to.....

Item No.	Quantity	Unit	ARTICLE

Do not fill in first column
Do not erase or interline Purpose.....
Put only one article on each line
Write plainly and give full description .....
Person authorized to sign chit

Form 2a

Stock No. 1	Quantity	Unit	ARTICLE	Unit price 5	Extension 6

U. S. S. COLORADO, Equip. Steam Eng. .....191..

Issue above to....., for.....
(Purpose)

Do not fill in Columns 1, 5 and 6
Put only one item on each chit
Write plainly and give full description .....
(Person authorized to sign chit)

as the case may be. The storeman changes the chit if necessary to accord with the unit on the books. For instance, a chit calls for 2 ft. ¼ inch brass rod. It reaches the stock ledger yeoman with the entry by the storeman, " 44B2, 1¼ *lbs.*" The stock tags should also have entered on them the low limit of the item, so that in looking at the tag the storeman takes in with his eye not only

the stock number he desires, but, if the stock is properly arranged, the quantity on the shelf, and the fact as to whether it is getting low. To avoid confusing the eye, entries on stock tags should be as few and plain as possible, and all on one face of the tag. The only other data I personally permit is in the case of reserve stock. The few tags concerned bear in red ink "RS," to indicate they are of this character; and in the same color, the number of the compartment in which the stock is located.

Errors in quantity issued are also to be guarded against. If less or more than the chit calls for, storemen should be strictly enjoined to change the chit to accord with the actual quantity delivered. Men from other departments calling for stores should not be depended on to see that chits are so changed. Scales and measures should be kept in all places in storerooms necessary, to make it as easy as possible for the storemen to get the actual data, otherwise they will guess. Even with all these measures the running inventory, described later, will develop differences in ledger and stock.

To illustrate the errors which the employment of stock numbers and the precautions outlined, are constantly eliminating, the following are selected practically at random from one day's chits. First the description of the item as written by the ship's department is quoted; then, in italics, storeman's entry:

"1 Bucket fire clay.....*25C1, 25 lbs.*"
"1 Bottle mucilage.....*53-M-2.*" (This No. is the small size bottle.)
"2 Screw eyes, iron.....*42SE2.*" (This No. shows that brass, not iron, screw eyes were issued.
"1 Gross wood screws...*42SWF16.*" *Issued 75 No.* (screws wood, flat-head).

Issues without receipts. The primary principle to be instilled in the storeroom force is that no stock whatever is to be issued except in exchange for a chit, signed by an authorized person. The commanding officer should determine who are to validate chits in each department. A list of these persons should be posted in the storeroom, and any chits turned in by a storeman not properly signed, returned to the latter for explanation.

Nearly every rule has its exceptions, however. After inculcating the importance of securing chits to cover all issues, it is necessary to instruct storemen that in times of great emergency stock may have to go out without waiting for a chit. In this case

they are immediately to report the facts to the office, and endeavor to get the necessary paper as soon as the emergency is past. When this class of issues may be made, must be left to the storeman's judgment.

There is another class of exceptions to this rule. Insignificant items as to value are occasionally wanted from the storeroom, such as, a two-inch square of tin, a single nut, a few tacks. Such needs are not worthy of the machinery involved in ordinary issues. They are too small to require the formality of a chit, and inclusion in the weekly stub. If not frankly recognized, there is a chance that these issues would be made by the storeman as an irregular favor. So he is provided with a common sense way of

Form 3

FORM FOR "ISSUES WITHOUT CHITS" BOOK, TITLE "X"

Date	Quantity	Unit	Article	Stock No.	Department	Sig. of Drawer	Value

Instructions to Storemen.

Enter *without fail* any issues of very small value made without chit to cover. No issue to be worth more than ten cents. Fill out each entry complete.

GENERAL STOREKEEPER

handling such instances, through an "Issue Without Chits" book, in which entry is made of insignificant items not covered by chit, to whom issued, and for account of what department. These entries should be initialed by the person receiving the stores, so that when the value of such issues becomes material, if it ever does, it may be covered by a special receipt from the department concerned. Form 3 suggests ruling for an "Issue Without Chits" book, and instructions for its use. In practice I have found this device little used, but a great convenience when it is employed, and it keeps storemen on regular ground.

Issues of exact quantity desired are to be encouraged. Storemen, to save trouble, to keep the stock looking better, or for other plausible reasons, are apt to issue out full packages only, such as a carton of screws, a full sheet of metal or glass, or a tin of

kerosene, when only a dozen, a square foot, or a gallon respectively, is wanted. In single instances, it may seem trivial to break a small package for an issue. There is a good reason, however, for insisting on exact adherence to the rule. Parts of items so drawn and not issued must either be stowed somewhere where they don't belong, or thrown away. Commonly they will be kept in out-of-the-way corners, "Magpie hoards," unaccounted for because already expended, until they get scattered, or disappear, or are finally swept up by some new broom and returned to the storeroom the worse for their experience. The only proper method is to leave the broken packages in the storeroom where they will still remain on charge and available for issue, and discourage the accretion of private stocks of supplies about the ship. Therefore, it is well to emphasize to heads of departments the desirability of drawing only what is needed for immediate use, and insist on the storeman strictly keeping to the rule of issuing exactly what is called for by the chit. An exception, more in seeming than reality, to this rule may be made in the case of cleaning gear, issued weekly to the different parts of the ship. This finds definite stowage in regular assigned places and is inevitably used up. But even such issues should be limited as far as possible, otherwise, when the end of the quarter comes, the departments will find they have stock to turn in for credit, under the order requiring this to be done with all items not to be immediately used.

Consideration of issues, as far as the storeroom is concerned, may be concluded by referring to Form 5 containing a typical set of orders to govern Title X storemen in making issues. It is essential these rules be strictly followed, or as stated by them, "both stock and books will soon get in a bad way."

Form 5.

U. S. S. COLORADO.

RULES FOR TITLE X STOREMEN'S ISSUES.

1. *Absolutely nothing* will be issued from this storeroom without a chit, signed by proper authority, except as indicated in following paragraph, and in cases of actual emergency. In emergency, storeman will report the issue without chit immediately to the office, follow the matter up, and get chit to cover at the earliest possible moment. Report to the office when it has been obtained. Nothing will be issued on chits not having the name of the person receiving the stores.

2. Make no "issues without chits" except of *insignificant* items, nor in any case of value exceeding ten cents. When made, post them promptly in full in the Issue Without Chits book.

3. Before filling chits, storemen will see that they are properly dated and signed. As the article called for is taken from its place, *look at* the stock tag, noting the correct stock number, the unit of issue (whether by lb., gal., yd., ft., doz., etc.), and the *low limit*. Do not *guess* at stock numbers, or put them on from memory; but *always look at the tag*. If the tag is lost, get another from one from the stock ledger yeoman and tag the stock at once. Put the stock numbers and your initials on every chit, as well as make any changes required on it, to have it represent *exactly* what was issued. *This must all be done before anything is issued to another customer.*

4. When the weight or measurement of any article delivered is different from the quantity called for by the chit, the person receiving it must be informed without fail of the change made.

5. Whenever possible, enough stock is to be kept on the main storeroom shelves to make all ordinary issues without leaving the storeroom. In cases where a reserve supply is kept in reserve stock storerooms, use slack times to fill up main storeroom shelves from the reserve. Where there are only samples of items in main storerooms, use sample to get stock number, and when necessary to make sure if it is the item wanted. Useless trips may thus be avoided.

6. Where a low limit is reached, make out immediately a Storeman's Request for stock, and give it at once to the stock ledger yeoman. Mark the request, if it needs special attention, or always if the stock has run out altogether, with the word "*Important.*" *Never get below the low limit if it can be helped.*

7. Make no issues to another ship without authority from the office. In such cases get a receipt bearing name, rate, and ship, from the person receiving the article.

8. *Remember,* no case except actual emergency justifies lack of care in carrying out this routine *exactly.* The accuracy and condition of title X depends, first of all on you, and if it is not followed strictly, both stock and books will soon get in a bad way.

Paymaster, U. S. Navy,
General Storekeeper.

RECEIPTS IN TITLE X originate in two ways. Ordinarily, when the low limit is reached, the storeman reports on a Storeman's Request for Stock (Form 1). This form is printed in duplicate on a perforated slip so that a carbon can be retained by the storeman to prove he took the proper action in case of subsequent inquiry. The requests are numbered consecutively. The numbers should be carefully noted in the office to prevent any straying before being given attention. If the storeman has any remarks

to make concerning an item appearing thereon, he should enter them on the face of the request, such as "big issues coming," "stronger cartons needed," "should be asked for in gallon bottles," "Jones says no more wanted." He also enters his estimate of the quantity which should be required for, though this is finally decided in the office, after consulting the stock ledger, and perhaps making further inquiry in the departments.

Stock may also be replenished through direct action by the office. The scrutiny of the ledger in posting expenditures, an independent investigation, the request of one of the ship's departments, or orders, may originate a requisition in this way.

It is usual, and the only safe course, in preparing for a cruise, to go over the Title X stock item by item to make sure that nothing is overlooked. It is well for the general storekeeper to have representatives of the department most interested do this with him, as the process elicits much valuable information as to the work planned by them for the future and its special requirements in the way of stock, which might otherwise be left to the storekeeper's imagination.

The head storeman should be furnished with a copy of all requisitions, with stock numbers entered thereon. New items are assigned stock numbers as soon as required for. This copy is used by him to check delivery slips, and the actual stores covered by them as they arrive and are laid out on the receiving floor. Items should not be taken from this floor until they have been satisfactorily identified, checked and inspected. Then only may they be melted into the stock. A practical advantage in enforcing this rule occurs from the fact that thus laid out, this new stock is usually unsightly and in the way, and so tends to hasten action on the part of the storeman in getting it inspected and checked. The storeman should be particularly careful when supplies of technical nature are received to have them passed on by someone detailed by the head of department concerned, who will "O. K." and initial the shipping memorandum or delivery slip, for record in case of any subsequent criticism.

On arrival at a yard, arrangement should be made for general orders to yard storeman, and men in charge of shops in the manufacturing departments to issue no material for the vessel, except to a duly authorized representative of the ship's general storekeeper. This will prevent its coming on board without the latter's

knowledge. This is especially important with items manufactured in the yard which are apt to be turned over to the ship's mechanics, brought on board and put to use, forgetting the necessary routine incident to the receipt of material. In getting stores from the yard, the ship's general storekeeper should see that representatives from the departments interested accompany the working party, so that the stores may be inspected before being drawn from the storehouse.

INVENTORY OF SUPPLIES should be always in progress. In spite of every care the books will be found to need constant, if slight, adjustment. After the trial several times of a comprehensive and exact inventory of Title X, the following is recommended as most likely to be accurate, and to wear least on the storeroom force. Provide the storemen with forms for a daily inventory by

Form 4

STOREMAN'S DAILY INVENTORY OF SUPPLIES, TITLE X

U. S. S. COLORADO

Instructions:—One to be filled out by each Title X storeman and turned in to stock ledger yeoman

Name of Storeman..... Date.....

Stock No.	ARTICLE	Unit	Quantity on hand	Gain		Loss	

each of them of, say, ten items, to be chosen by themselves in the course of the day's work. This form may conveniently be as shown by Form 4, which has been successfully used. The storeman is thus relieved from facing the big job of an inventory with the monotonous counting it involves (which no one can continue long with accuracy), and in lieu is given a light daily task which he can absorb in his regular duties in the issue and care of stock. These forms when filled out, except as to the last two columns, are turned in to the stock ledger yeoman. He compares the quantity on hand with that on the ledger, enters in the ledger the date of the inventory, and makes any necessary adjustment to accord therewith, as well as adding the gain or loss involved on the inventory sheet. The sheets are then filed for use

in making up the vouchers to cover the gain or losses for the quarter. If the stock ledger yeoman suspects from his comparison with the ledger that a mistake may have been made in the count, he crosses the item from the inventory sheet and directs a recount. From time to time he goes through the ledgers and notes items which have not been inventoried for too long a period, for an early count by the storemen.

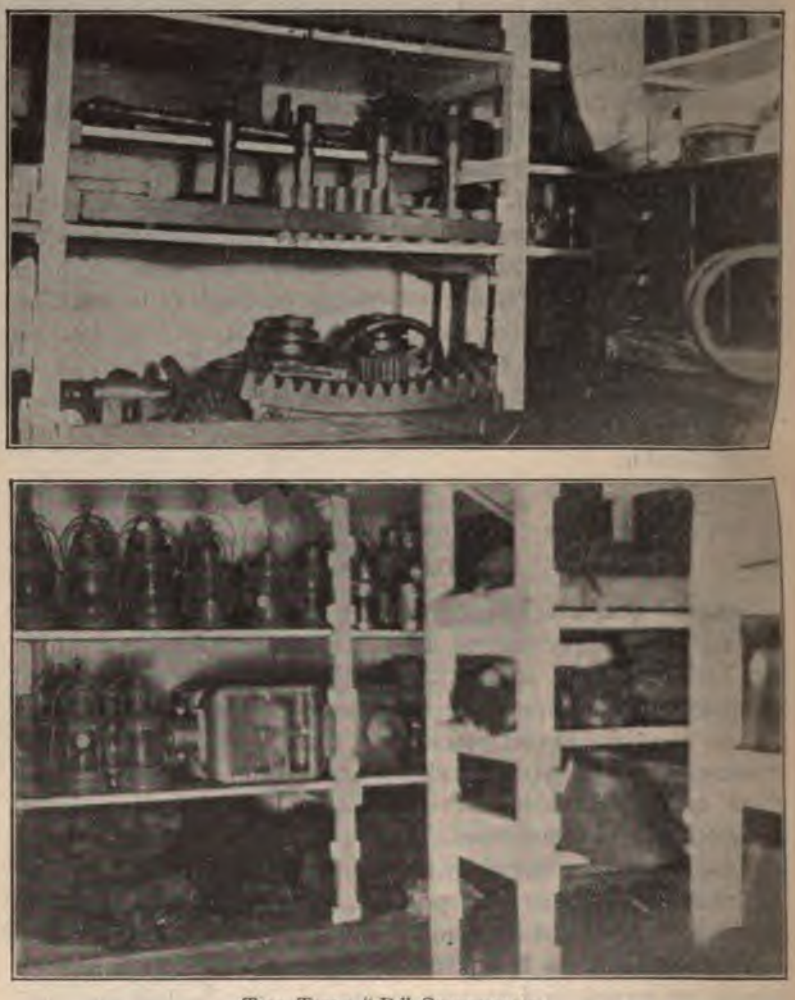
The comparison of storemen's requests for stock with the ledger should often lead to an inventory, to take advantage of the favorable conditions for an accurate count provided for by a depleted stock. The frequent inquiries received as to stock on hand should be followed up for the same purpose. In fact, no chance should be lost to compare stock and books, and to keep the storemen constantly aware that this is done, and with their pride aroused if possible to see that discrepancies are as small as practicable.

EQUIPAGE TITLE B.

STOREROOMS.

General characteristics. Most of what has been stated concerning the arrangement of Title X storerooms applies to those for Title B. The application of the storekeeping axioms to equipage produces much the same results. To concentrate it as far as possible, to get stocks "in store" where they can be constantly within vision and subject to supervision, to make them easily accessible for issue properly, requires an interconnecting set of storerooms with a gang of interested, standardized storemen, standing in regular watch. As with Title X, these storerooms, if possible, should have a common entrance to combined issue and receiving room, where those who call may wait while being served, and where items received on board, or turned in for store or survey, may be laid out until proper action be taken.

The care of surveyed material constitutes an important element in equipage storekeeping, which can be almost disregarded in Title X. Supplies in store should require survey only infrequently, while damaged or worn equipage is constantly being turned in. To provide for this, the series of storerooms for equipage must have a compartment set aside for surveyed items.



THE TITLE "B" STOREROOMS.

The upper picture shows a part of the receiving room with Storeman's desk, and shelves of Class 1; the lower picture, a corner of an adjacent compartment, showing parts of Classes 12, 13, 31, 36 and 37. This latter storeroom contains all equipage "in store" Classes 5 to 37, arranged by classes and alphabetically in each class, except 10 and 11 (stored with 60 and 61), 16 and 17 (electrical, have special compartment immediately below), 19, 20 and 22 (in hold), and 35 (in library cases).

A storeroom 12′ x 8′ x 6′, fitted with proper shelving, is none too large for this purpose. Material waiting survey has to be kept so that it may be readily examined, and separate from that already surveyed and waiting the disposition recommended. It is surprising how surveyed material collects in the ordinary routine of a ship, and it is almost invariably of a kind which is difficult to stow closely or to keep from being further damaged without adequate space for it.

Special fittings for equipage need be discussed only with reference to equipage "in store," either as spares to be issued to replace working parts as they break down, or as items subject to withdrawal and return after temporary use. Equipage in continuing or "permanent use" concerns the office rather than the storeroom part of the general storekeeper's work, as he merely keeps its accounts and has nothing to do with its custody, that being wholly the care of the ship's departments.

FITTINGS FOR MAIN STOREROOMS have to be provided for items of the most varied character. General suggestions only as to what these fittings should be can be given here, as the character and arrangement of the storerooms have much bearing in determining them. The requirements for receiving rooms as to shelving, desk and storemen's lockers given for Title X apply. A rack should be installed here to receive library books as they are turned in. About 850 linear feet of shelving is estimated as necessary for the equipage in store of a first-rate ship, but it cannot be so regular in dimensions as that provided for Title X. A certain length, say a hundred feet, will have to be extra heavy to accommodate spare engine and auxiliary parts. In the ideal storeroom enough open space would be left to care in their proper classes for bulky items like armatures the illuminating set, dynamo covers, hospital cots, mattresses, etc. A light rack to carry the bags in which they are put, is needed for flags. One 12 feet long with notched parallels, 24 inches apart is good for small spare armatures. A part of the storeroom system should be fitted for hand tools, which are used temporarily and returned to store. As there is more traffic to this part of the storeroom than any other, it should be convenient to the issue room. Shelves should be as thoroughly lighted with small lamps as with Title X.

FITTINGS FOR OUTLYING EQUIPAGE. The libraries are usually provided for outside the storeroom. The ship's library (books of

reference and serious works, to the number of about 900 volumes), is commonly kept in the officers' quarters and mostly used by them. This, together with the crew's library (also about 900 volumes, mostly fiction), should be kept in glass fronted cases, the bottom shelf raised somewhat from the deck. They should be as open as possible for inspection of the titles of the books, while being under lock and key. Many ship's bookcases now have solid doors.

Coaling gear is preferably stowed on the upper deck where it is most convenient for use and makes the minimum amount of dirt. A locker 14′ x 12′ x 6′ has been found to be sufficiently large for this. Water breakers, like abandon ship rations, must be kept in a promptly accessible place. A locker 6′ x 8′ x 6′ on the upper deck will do for this purpose. Mine gear being special and seldom used, may be given a separate storeroom without sacrifice. So also may have to be other bulky and seldom used items, such as the large armatures, illuminating set, quarter-deck awnings, tents, etc., named above.

EQUIPAGE TITLE B.

STOCK.

An understanding of the variation in stock keeping methods for equipage from those described for supplies, will be helped by detailing here the specific differences between items in Titles B and X. Equipage is subject to survey after use; supplies are not. Hence it is necessary to follow the course of equipage after issue, and generally to receive it in the store again when worn out, to arrange for its final expenditure. Equipage is carried in a fixed allowance for each ship's department under each item. Supplies allowed are carried for issue in any quantities as needed with a quarterly money allowance only for each department to govern its total expenditures during the quarter. Equipage afloat has been paid for by the appropriations supporting the various ship's departments, and is therefore carried under the cognizance and supervision of the respective heads of departments. Supplies are not paid for by the bureau appropriation until actually drawn, and are therefore more strictly under the undivided cognizance of the general storekeeper. Equipage may be either "in use," or "in store." Supplies are "in store" only.

When put to use, supplies usually lose their identity as individual items. Much equipage "in store," tools, flags, etc., is issued again and again for temporary use and return. Withdrawal for temporary use practically never happens with supplies. Supplies being in a single account, all items of the same kind can be grouped together without distinction. With equipage, where frequently similar items are carried several accounts (hammers, ball peen, for instance, in C. & R., SE., Ord. and Equip. Departments), care has to be taken to distinguish between the property of the different departments.

Concentration of equipage "in store" is most desirable. All such items possible should be collected and systematically arranged in the storerooms allotted for equipage. This arrangement should consist primarily of segregation by classes. Fortunately, the classification adopted generally permits whole classes to fall under the cognizance of one department. But where this is not so, as notably in Class 41 (hand tools), experience now indicates that items of the same kind should still be put together though the property of the different departments, being distinguished in some other way than by physical separation. Different colors can be used for the different departments, marking the individual items with paint where possible, or the shelves on which they lie with the proper distinctive color.

As with "X," there will be some forced exceptions to a strict arrangement by classes, due to special characteristics of items, or the limitations of the storeroom; but in general it will be found that such arrangement is feasable, and that where applied, all transactions with regard to the stores concerned are simplified.

STOCK NUMBERS FOR EQUIPAGE will also be found to increase the certainty of all operations relating to it. A practical system is one in which the items having been arranged on the ledgers by classes (and if necessary, as with ordnance, with classes, subdivided), and alphabetically within each class (or subdivision), each department is given its distinctive series of numbers by indicating first the initials of the department; second, the number of the class; third, the initial of the item, and last, the serial number of the item under that class and initial. The final number need not indicate the exact position of the item in the ledger, inasmuch as the character of references made to the books makes it desirable to have the alphabetical arrangement govern. This situation

differs from that under Title "X." Nine-tenths of the use of stock ledgers for supplies is in posting expenditures already identified by stock numbers. In this case time and labor are saved in finding ledger pages, by keeping the number sequence unbroken. With equipage, present experience teaches that in most of the inquiries or transactions affecting the ledger, the name of the item features more prominently than its stock number. Hence with B the alphabetical order should control. In either case, one or the other sequence should be absolutely adhered to, or confusion will result.

The most desirable condition is to have both systems, letters and numbers, constantly run together. This is possible with equipage, as comparatively few new items are received after the ship's outfit has once been supplied. When new articles come, therefore, it is well to make the few changes in stock numbers usually required, to conform with the strict alphabetical arrangement, and keep stock and ledgers completely and consecutively indexed either way. With X the strict consecutive series of stock numbers has to be broken temporarily now and then by "dash numbers" as later described.

Illustrations of the stock number system for equipage follow. Ordnance galvanized iron buckets being the first item under B in Class 12, in ordnance, has the number O12B1. The same kind of bucket in steam engineering, being preceded in the B's of Class 12 by Boards, bulletin (key, muster, station), and buckets (ash and coal), are SE12B7. ESA28D2 represents doilies, wardroom, Class 28, department, Equipment S. & A. Similarly O41S10 indicates ordnance screw-drivers, Class 41.

These stock numbers are indicated while "in store," by circular metal rimmed tags attached to the items concerned. Usually the particular sample bearing the tags can be left in stock. Where, however, it is necessary to issue for temporary use, the tag is removed, and hung on the shelf until the item is returned. If the item is withdrawn for permanent use, the tag should be saved by the storeman until further supplies are received. The possibility of the temporary separation of the tag from the item makes it desirable to add to the information carried by the tag the name of the item, as well as the stock number and the low limit, as with Title X. The entry of the unit of issue, so essential on the

Title X stock tags, is not usually necessary with those for Title B.

In the cases of Ordnance and Equipment-Steam Engineering, it has been found convenient to subdivide the largest classes before starting the alphabetical arrangement. All parts of all guns, for instance, are under Class 1. These are so numerous, and the unofficial nomenclature for them so varying, that results are much more certain if the items are subdivided by calibers and under the main elements of the gun to which they pertain. The index to the ordnance ledger of an armored cruiser, Form 6, shows the divisions into which her Class 1 naturally falls.

FORM 6.

SYNOPSIS OF ARRANGEMENT OF ORDNANCE LEDGER.

U. S. S. COLORADO.

Stock ledger sheets are arranged by classes consecutively and in alphabetical order in each class or division under each class.

Stock Numbers.		CLASS 1. Items are grouped as follows:
From	To	8-INCH.
O1A81	.....	Guns, complete.
O1B81	O1B819	Carriage, complete and spares.
O1C81	O1C84	Slide, complete and spares.
O1D81	.....	Stand, complete.
O1E81	O1E814	Breech Mechanism, complete and spares.
O1F81	O1F810	Sights, complete and spares.
O1G81	O1G846	Firing Locks, complete and spares.
O1H81	.....	Attachments, elec. firing, complete.
O1J81	.....	Attachments, night sight lighting, complete.
O1K81	O1K82	Gas Ejectors, complete and spares.
O1L81	O1186	Miscellaneous.
O1X81	O1X811	Ex-Caliber, complete and spares.
		6-INCH.
O1A61	O1A62	Guns, complete.
O1B61	O1B644	Carriage, complete and spares.

(A similar arrangement to the 8-inch for this and all other calibers.)

CLASS 2. Items are grouped as follows:

8-INCH.

O2A81	.....	Guns, special equipment for.
O2B81	O2B814	Carriage, special equipment for.
O2C81	O2C85	Stands, special equipment for.

(Similarly for remainder of items of this caliber and all others.)

CLASS 3. Items are grouped as follows:

AIR COMPRESSORS.

O3P1	O3P23	Complete, and spares.

(Etc.)

CLASSES 11 to 65. Arranged in strict alphabetical order, using the initial letter of each item in the stock number in place of the arbitrary letter used after Class Nos. 1, 2 and 3.

In cases like this, the system of stock numbers must be varied slightly, assigning arbitrary symbols throughout the class to these various elements, indicating the caliber or character of the gun. To refer to the typical index given, the letter B is assigned to anything which pertains to a carriage, the letter E to anything relating to a breech mechanism. The figure or letters following this symbol denote the caliber concerned. Thus, O1B86 indicates ordnance Class 1, carriage eight inch, balls, one inch diameter, variable speed gear, spare. O1E810, indicates springs, tray, latch, catch, spare, in ordnance Class 1, eight inch breech mechanism. It must be remembered that the final number has no significance except to distinguish it from the other items in the category described by the letters or numerals preceding, though an effort is made to have it indicate the proper *alpha*betical letter of the item in that category. Similarly, O1B3FG1, indicates bar, trail and coupling for the three inch field gun carriage. This system, though apparently intricate, is in reality quite simple, and solves the problem presented by the great number of different items in the ordnance classes, and the various usages with regard to their nomenclature.

An objection to the system of stock numbering for equipage outlined is seen in the example given of galvanized buckets. The same item may have several different numbers. Hammers, ball peen, lying on the same shelf, would have four different numbers. This cannot be helped under the present system, though it indicates a defect which must sooner or later be cured, *i. e.*, the carrying of items suitable for general use under any but a general account. This situation might be solved either by transferring such items to Title X, with provision for their being loaned out until lost or worn out when their cost could be prorated and charged by survey to the proper appropriation; or by carrying them under the sole cognizance of one appropriation for the use of all departments, as was done with items of Title X type allowances for torpedo craft.

Accessibility of equipage "in store" is also of prime importance. Many items are needed in haste. They should be instantly producible in good condition. Arrangement so far as possible in classes, and alphabetically in each class, conduces to this. Pasters should be put on the edge of the shelves explicitly indicating the department concerned, and, if the alpha-

betical order is broken, where the missing items in the class may be found. A man always on watch, and the storeroom always open, induces the confidence of the departments. This is more important with B than with X. With the former, the head of department may exercise his judgment as to what may be left in store, and withdraw and put into permanent use. If he has confidence in the accessibility and care given his gear, he will be inclined to turn in all possible. This is the ideal condition, as the fewer items there are out about the ship which are not in actual continual use the better.

The question of reserve stock does not arise with the same insistance as in Title "X." With few exceptions, either all or none of the spares in any item of equipage can find place in the storeroom. Ditty-boxes, however, form such an exception. There must be a few of these ready to issue, but it is scarcely to be hoped the full stock of spares can be carried in the main storeroom. A list of all items "in store," but not in the main storeroom, with their stock numbers and location should be kept on the storeman's desk to help the ready finding of any item not in its proper order. This will serve for all cases of stock not concentrated, and will supplement the directions on the shelves.

The ship's library may be made easily accessible without loss in accountability, by the use of the wardroom wine-mess boy as its custodian. This boy is usually selected on account of his intelligence, and is accustomed not only to keep things under lock and key, but also to get chits for what he issues. After the books have been arranged and the catalog posted, give the wine boy the keys to the book cases and charge him to be as particular to get chits for books as he is for cigars, and to try to collect the books on the first and fifteenth of each month, and an effective solution will be found to the question of the handling of the ship's library.

Maintenance of title B stock is the one part of work with equipage which is simpler than Title X. The renewal of equipage ought to take place almost automatically, if the allowance lists are kept corrected to current conditions. The object of the general storekeeper is to maintain in good condition on board the allowed number of each item, in spite of casualties. When this number is increased by transfer or by loss, requisition is made to complete the outfit once more. Many items of spares allowed in quantities greater than necessary to meet any ordinary

depletion, such as tools, crew's mess gear, ditty-boxes, etc., may be allowed to run down to a pre-determined low limit before completing the allowance. This saves a needless multiplicity of requisitions. On such items a low limit is established after consultation with the head of department, and entered on the stock tag and ledger sheets in the same way as with X (see Form 7). Ordinarily, however, no such watchfulness as with

Form 7

MEMORANDUM OF TITLE "B" ARTICLES TURNED INTO STORE FROM "PERMANENT USE"

U. S. S. COLORADO .....191..

Instructions:—To be filled out by storeman on watch and sent to office of general storekeeper when *any* item is turned in which has been out in "permanent use."

Stock No.	Amt.	Article	Dept.	Turned in by	Date turned in	Condition of article	Initials of storeman

X is required by the storeman in keeping up stock. All they have to do is to make sure chits are received to cover all movement of stock, and that these chits are put in the proper course.

It may be noted here that the allowance lists of equipage of many ships are in great need of revision under some co-ordinating influence. For example, at the present time, each of several bureaus has allowed its ship's department enough tools of a certain kind for the entire ship. Thus money is uselessly invested, and the ship forced to carry much needless gear. An illustrative case is that of monkey wrenches. The allowance lists of the *Colorado* call for the maintenance on board of the following:

24"	Wrenches	allowed	2,	of	which	2	are	usually	in	use.
21"	"	"	19,	"	"	2	"	"	"	"
18"	"	"	30,	"	"	8	"	"	"	"
15"	"	"	29,	"	"	8	"	"	"	"
14"	"	"	2,	"	"	7	"	"	"	"
12"	"	"	52,	"	"	27	"	"	"	"
10"	"	"	42,	"	"	21	"	"	"	"
8"	"	"	43	"	"	26	"	"	"	"
6"	"	"	30	"	"	14	"	"	"	"

This is not by any means the only instance of apparently excessive allowance, nor should mention be omitted of the good work

a revision of allowances could do in pruning out altogether much that is obsolete, or unnecessary, from the present lists.

Custody of equipage is somewhat more difficult than of supplies. Items of equipage tend to be more varied, complex, and delicate. The use of tools, the rudiments of electricity, a superficial knowledge at least of ordnance material, in general a quick perception of mechanical relations, is necessary in the head Title B storeman. A man with these requirements is not so hard to secure aboard ship, as many with mechanical turn of mind select the service particularly in the engineer's force. The best storeman available is not misplaced when put in charge of Title B.

There are many methods in the care of stores yet to be generally learned. They may be largely inspired by the constant sight of stock on the shelves illuminated as described for Title X. In case of any question as to the condition of equipage in store, the expert advice of the technical departments should be sought. In many cases it is well to invite representatives of these departments occasionally to go over their stock with a view to offering suggestions as to its care. Amongst the precautions for equipage, the following may be mentioned as a far from complete schedule. Very small parts in ordnance should be put in manila envelopes (3½" x 5", open end), with the stock numbers, name of item, and, if necessary, the low limit written on the outside. Many of these parts are too fine and small to take a stock tag and are less likely to get lost or deteriorate when thus carried. Slightly larger items can be arranged and safely kept in open cigar boxes neatly painted. A plentiful supply of these can always be obtained from the canteen or the wine-mess. Flags should be kept in camphor in paper bags, the bags being stenciled on one end with stock number and name. Fabric items of battalion gear, athletic outfits, etc., should be camphored. Rain clothes should be done up in neat bundles packed loosely, and occasionally moved to guard against combustion. Case-hardened steel should be kept with a film of oil over it. Bright steel should either be kept bright with a coat of oil, or in case of large parts not likely to be used for a long time and needing protection from scoring, like piston rods or valve stems, be heavily painted or covered with white lead and tallow and sewed up in canvas. Brass and nickel should be kept bright.

Boxes of spares should be kept filled sedulously. Whenever an issue is made from such a box, the rule should be to take immediate action to replace. Ordinarily the broken item which causes the issue is turned in. The exchange thus effected of a good for a worn item will in itself start a survey. The worn one becomes "spare," and is surveyed as such. If the article replaced is not turned in, the chit marked as "missing" should be sent to the office for a survey. Sometimes it is possible to replace an item in a box of spares from X stock. In this case the head Title B storeman should secure a chit from the proper head of department in the usual way.

Accurate accounting for equipage is accomplished as follows:

ISSUES OF TITLE B from store under any of the various appropriations are naturally divisible into three classes. A glance at a Title B chit (see Form 8) will show it provides for *items* issued:

1 For temporary use and return to the storeroom.

2 To replace items (turned in / missing) for survey.

3 For permanent use and charge on custody record of.....

Form 8

TITLE B, "COLORADO," BUREAU.....

Issue to .....Date.....1912

Storeman's entry	No.	Do not erase or enterline, write plainly, one item only on each line. Full description of article.

NOTE: Indicate below whether required:

(a) For temporary use and return to storeroom

(b) To replace item (turned in / missing) for survey

(c) For permanent use and charge to custody record of: ..... Person authorized to sign chit

.....

Issues for temporary use are the most frequent. These are of tools for the most part, but may be of any sort of item, lamps, books, rain clothes, athletic gear, dotters, portable lights. The list might continue almost indefinitely. The storeman examines

the chit in such a case to see that it is properly complete, and particularly whether it is held by the person indicated to receive the item (or a proper messenger from him), and is signed by one authorized to validate chits. The storeman then makes the issue, enters the stock number on the chit, secures the receipt of the person actually receiving on its face, if other than he to whom issue is ordered, and files it alphabetically under the name of the latter, with other "temporary use" chits. On return of the item the storeman surrenders the chit and the transaction is complete,

Form 9

U. S. S. COLORADO

Job order request No..... .....191..

From: GENERAL STOREKEEPER.
To : COMMANDING OFFICER

Subject:—Requesting issue of ship's job order for work within capacity of ship's force.

1. I request you direct that necessary repairs be made to items "in store" indicated below:

Dept.	No.	Item	Recommended by

Paymaster, U. S. Navy,
General Storekeeper.

Approved and forwarded to Head of.....Department, who will see that necessary repairs are made to place above items in proper condition for issue or transfer.
Return with report when completed.

Captain, U. S. Navy,
Commanding.

Items drawn on "temporary use" receipt, work completed and items returned to store.....191..

.....U. S. Navy,
Head of Department.

no book work being required. If the item is returned in poor condition as to cleanliness, etc., the storeman may refuse to receive it until it has been put in proper shape. If it is damaged he receives, tags it with the name of the person turning it in, and immediately reports the item to the office for survey. Articles needing repair within the capacity of the ship's force, as recommended either by survey or on independent investigation of the storekeeper (see Form 9), are withdrawn by the department making the repairs, on a temporary use chit. At present the supplies required in these repairs are drawn by the departments under their money allotments for current maintenance, though strictly speak-

ing their value should be recorded separately as a charge under Title P, and the allotments relieved from these expenditures.

Repairs to equipage beyond the capacity of the ship's force, when recommended by survey, are made by the yard, and the cost reported under Title P by them. In such cases the items are sent to the yard shop on a memorandum receipt, and when repaired are returned without the formality of a double transfer. This procedure is convenient, but it involves the exercise of care that all such items are returned before the ship leaves the yard.

Library books, (ship's and crew's) and ditty-boxes require special forms of issue for temporary use. A method for facilitating the use of the ship's library has been referred to. The crew's library requires the formulation of a set of regulations both for the persons drawing books, and for the storeman issuing them, depending upon the facilities and ideas of administration of the ship concerned. Asset of such rules which has been found to work well is shown below as Form 10. It is very convenient,

FORM 10.

U. S. S. COLORADO.

ORDERS FOR CREW'S LIBRARY.

FOR PERSONS DRAWING BOOKS.

Books may be drawn at *1 p. m. Wednesdays*, and *9 a. m. Sundays.*

All books must be returned to the Title "B" storeroom (opposite sickbay) where they will be received by the storeman on watch at any time. Books will not be received for return at the library. No book shall be kept out more than *15 days*. On return, receipts for books should invariably be obtained from storeman and destroyed. *Otherwise report that the book is overdue may be made to the executive officer.*

No book will be received on return in damaged condition unless the word "worn" is entered on the receipt at the time of issue, to show its poor condition.

A numbered catalog of the library will be kept on the "LIBRARY BULLETIN BOARD." All persons must choose the book desired, noting number, before the time of issue, as, to expedite the issues, no examination of books will be permitted at that time.

FOR STOREMAN.

Books will be numerically arranged and kept that way. Before the issue hour, all books returned must be taken to the library and put into proper places. During the issues no one will be allowed in the library compartment except the storeman. There must always be present two men to make issues: one man to fill out receipts, and one to get books from the shelves.

If but one of his storemen is available for this work, the Title B storeman in charge will apply to the pay office for assignment of another man.

After issue, all receipts will be taken to Title B storeroom and filed by number. On the 1st and 15th of each month report shall be made to the G. S. K. office of all books outstanding more than *15 days* and names of persons drawing them.

Be sure to deliver receipt therefor to every person returning a book.

Paymaster, U. S. Navy,
General Storekeeper.

for instance to provide that books of this library may be returned in to the Title B storeroom at any time. The books come back more quickly and are saved being knocked about the decks after the person drawing them has lost interest in them. It is also a good plan to prohibit the turning in of books during the hours of issue. This simplifies the work and reduces confusion of the latter process. Often a hundred men will be in line to draw volumes. Ordinarily, two storeman should attend to the issue, one to get the books from the shelves, the other to prepare the receipts. These receipts are kept in the Title B storeroom to be returned as the books are turned in.

The simplest method for keeping track of and recording issues from the crew's library is by the use of an unbroken series of numbers which are assigned to the books whenever rearranged and catalogued, and pasted on the back of each volume. It is preferable when this arrangement is made to put the books in alphabetical order, either by title or author, so that the numerical sequence may run with the alphabet. But the number should control, and accessions to the library must be added on the last shelf to the number series, regardless of the name. With the catalog showing the number of each volume, all business can be done by it; the book being called for, found on the shelves, and turned in by the use of the number only. A bulletin board is found to be the best means for posting the library catalog. Any list not protected by glass soon becomes defaced or misplaced. The bulletin board is also convenient for the posting of library notices, such as the regulations governing it, list of new books received, interesting books at the moment, like those on the country the ship may be visiting, etc. Form 11 shows a convenient style of chit for crew's library books.

Form 11

_____ I acknowledge to have rec'd the crews library book below
Book No. described. (Sig.).....
(Write your name plainly.)

Date..... Rate.....

RECEIPT FOR LIBRARY BOOK, TEMPORARY USE, TITLE B.

"U. S. S. COLORADO"

Name of book.....

Author.....

Ditty-boxes, although, strictly speaking, equipage in permanent use, can be handled more conveniently with temporary use chits. Many men have ditty-boxes who are responsible for nothing else. The custody record is thus saved the addition of many names which would otherwise appear in it. It will be noted that the form of chit submitted as Form 12 requires the man's receipt.

Form 12

DITTY BOX RECEIPT .....
Name

Temporary Use—Title B

U. S. S. COLORADO .....
Date

I acknowledge to have received one government ditty box; to be kept in as good condition as possible, and turned in before leaving ship.

.....
Signature—write as plainly as possible

Distinguishing Marks on Box .....
Rate

..... Lieut. Comdr., U. S. N.,
Executive Officer.

This addition, not found in the other forms of temporary use chits, is made merely with the view of further impressing upon the ordinary type of man his responsibility for the care of his ditty-box. It means more to such a one to have "signed for" a box. These chits may be either kept in the storeroom or in the office, depending on the personnel in each, so that when a man is transferred, or turns in his box, there shall be the least chance of overlooking the receipt.

Ditty-boxes should be identified by a consecutive series of numbers in the same way is library books. No government box should be permitted to remain in use without an identifying number, and no box should be issued without one. The number of all boxes should be marked on the receipt. Thus when any get adrift, or into the lucky bag, they can be easily identified.

The head storeman in Title "B" should be instructed to go over the temporary use chits in his file at least once a week and report to the office any cases in which items have been out over a month. This will lead to discovery of cases of loss which have not been reported, and keep the temporary use list in a healthy condition. It will frequently be found that items drawn for temporary use have passed into permanent use, in which case they should be put in the latter category and placed on the custody record as later described.

Issues of spares to replace loss or damage to equipage already in use constitutes the next most numerous class of issues. Ordinarily the broken or worn article is brought to the storeroom with the chit to cover its exchange for a new one. A chit is necessary to make sure that the head of department or authorized person signing it has knowledge of the damage. The chit is taken up by the storeman when he makes the issue. He enters the stock number on it for further identification, tags the broken item with stock number and name, and puts it in the survey section of the storeroom. He then sends the chit to the office to start the survey.

There are two variants to this procedure. Sometimes the nature of the case is such the new item must be drawn before the old one can be taken from place and delivered. In this case the storeman makes the issue, takes the chit and holds it on his desk for special attention until the transaction is completed by delivery of the old item. Sometimes the old item has been lost, or has otherwise disappeared in the casualty requiring the issue. In this case the storeman makes the issue, makes sure that the word "MISSING" is properly indicated on the chit, and sends it to the office for the special character of survey required. No case involving the simple replacing of equipage affects the custody record for, obviously in all such cases, the number in the custodians possession remains the same.

Issues for permanent use constitute the third class of issues of equipage, and while the least numerous involve the most clerical work. The storeman is instructed with such issues, to be sure that beside the data usually required on other chits, there is also entered the name of the person into whose custody the item is to pass. The chit is then sent to the office at once for preparation of the custody record, and is carefully retained until the record is signed. Storeman should be directed to accept any items in per-

manent use turned in, whether with or without accompanying authority; but when such items are received, they should make report at once to the office. Form 7 previously printed, is a useful one for this purpose.

Except in case of emergency, there should be no issues in B without receipts, there being no circumstances except emergency making such necessary or advisable.

RECEIPTS IN TITLE B are treated much as in Title X. They are laid out on the receiving floor until identified with the item and requisition under which drawn, given a stock number, and inspected by a representative of the department concerned. That this last should be carefully done is particularly important. The head of department depends on the outfit provided for his department to be on board, and of proper type. His inspection of all newly arrived equipage, either in person or by competent proxy, should be insisted on by the storekeeper. Only in this way may the latter be assured that items suitable to the department have been supplied. Now and then, articles of old type or character, not suited to the particular vessel, will be sent from the yards in spite of all care by the yard storekeeper. As in the similar inspection under X the storeman secures the written O. K. of the person inspecting upon the delivery slip or shipping memorandum. The inspector's initials should be noted also on the Record of Requisitions for ready reference, in case of future question.

SURVEY EQUIPAGE is constantly collected as a result of casualties, natural and otherwise. As indicated, part of the available storeroom space should be specifically set aside for it. Damaged stock should never be mixed with the good. Articles awaiting survey and those surveyed and held to turn in, either to supply ship or storehouse, should be kept separate. If pending this opportunity, use can be made of surveyed items, they may be drawn on temporary use chit marked "surveyed" in large letters across the face. The item can then be easily found to call in when required.

The regulations permit summary disposal of condemned articles of negligible value, or whose usefulness is wholly destroyed, by burning or throwing overboard. This practice not only results in economy in office work and transportation, but gives great relief from the conditions of former practice which required all condemned items, no matter how worthless, to be kept and turned

in. Items of value which ought to be turned in accumulate rapidly enough in the ordinary wear and tear of a city of machinery. As they collect, they should be tagged immediately with name of ship, department concerned and stock number. When surveyed they should be packed at once for transfer at the first opportunity, but the box or package in which placed should not be finally secured until its contents have been checked by one of the office force, and each tag marked with the item invoice number. Finally a copy of the invoice of the contents should be placed in the box. The differences which frequently arise over invoices and the contents of shipments containing surveyed material, after their arrival at the yard, make it very desirable for the ship to be sure of its check. To do this it is well to have two men present when the contents are finally verified and the box sealed. The outside of the box should have plainly marked on it, besides the forwarding address, the name of the ship, bureau, and invoice number. Items of more than one bureau should not be packed together unless necessary. There is a particular reason for insisting that care be taken with such shipments. The worn and broken character of the items makes identification more difficult, and frequently they are sent to a yard at a distance, via a supply ship or collier, which makes it hard to adjust misunderstandings and differences in count. Because of its character, it is also found that storemen are inclined to treat survey equipage carelessly, and that unless an effort is made to anticipate the rush which seems to be normally incident to the transfer of stores, it will be dumped into store in a condition not creditable to the ship. The way in which surveyed gear is turned in is one of the best tests of efficiency of a ship's storeroom force.

INVENTORIES OF EQUIPAGE should be kept running. These are complex, as items in use have to be considered as well as those in store. Blanks (Form 13) should be supplied the storemen for the entry of the quantity in store. Items under one Bureau are chosen by him up to a designated number each day, and the quantity in store counted. The forms complete as to stock number, unit of quantity, and quantity in store, are then sent to the office. There, the correct name of item, balance on ledger, quantity in use, and custody record are entered. They are then forwarded to the department concerned, which checks up the quantity in use, whether permanent or temporary, and returns the forms to the general stor-

keeper's office for comparison with the stock ledger. Thus is put into operation a method which avoids the monotony and consequent errors of a continuous consecutive inventory. Whenever desired these forms may originate in the general storekeeper's office for items in doubt, or not recently inventoried.

Form 13

Daily Inventory of

TITLE "B" AND CUSTODY RECORD

U. S. S. COLORADO Date* Bu.*

(Storeman fills out all spaces marked *)

Item.....

.....

Unit of Quan.*..... Balance on ledger.....

In store*..... In use..... Total.....

Gain or Loss .....

CUSTODY RECORD

No.	Name	Rate	Location
.....			
.....			
.....			

Stock No.*

It may be considered more to the satisfaction of the other departments to conduct the inventory of equipage in use by *persons* rather than by *items* as here described. In this case the storeman's inventory of the quantity in store is made as indicated, and the upper half of the sheet completed at the office, the quantity shown on the books as in use being assumed to be correct. This assumption is not justified by experience so far, which is, that differences between the ledgers and the quantity actually on hand are, if anything, more likely to appear in the portion of the item in use than in that in store. This is due to the fact that breakages and loss are constantly occurring which are not reported to the general storekeeper's office, by any of the various agencies from which such information should come, such as the head of department, officer-of-the-deck, officer of engine-room watch, or the man concerned. Frequently not one of these persons knows of a loss until the checking up incident to the inventory takes place. Often again the custodian alone knows of it, and fails to report. However, that may be, the loss of equipage in use eventually comes to light

if copies of all the custody sheets of each person in turn on the custody record are methodically forwarded to the heads of departments to be verified in that way. Undoubtedly, this method would be easier for the general storekeeper's office and the Department, than to take the inventory by *item,* where perhaps one daily inventory sheet would involve several persons; but its value as a count would not be so great. I, therefore, prefer the plan first outlined.

Special equipage inventories are those of the libraries and of officers' mess gear. With the system of numbering books described the former is simple. Either the book or a numbered chit should represent every number in the catalog. The count of officers' mess gear at the end of the quarter should be made by a yeoman on arrangement with the mess treasurer concerned whose presence would be secured at the inventory if possible. If desired, a muster at sea of ditty boxes can easily be accomplished.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE UNITED STATES SHIP *IDAHO*.

REMINISCENCES, 1866-1870.

By REAR-ADMIRAL O. W. FARENHOLT, U. S. Navy.

Few ships of our navy have had a more eventful, if short, career than the first *Idaho*. She was about one-third of the tonnage of her namesake, the present battleship *Idaho*, yet when afloat, and for many years after she was broken up, she was, and had been, the largest sailing vessel of all maritime nations.

During the last two years of the Civil War, we laid down and built twelve large commerce destroyers, and but few of them had been launched with the war was ended, and four of these vessels were broken up on the launching ways many years afterwards. These ships were to have been the largest (from four to five thousand tons burden), the swiftest, and most powerful armed vessels afloat. All were built of unseasoned wood—no other was obtainable—and ten years later, not one of them was in active service. They were called the *Wampanoag* class, and had quaint Indian names. I remember the *Wampanoag, Passaconaway, Memphramagog, Piscataqua, Katahdin, Pushmataha,* and others.

The *Idaho* belonged to this class, although totally different in many respects. She was built in New York on the lines of the yacht *America,* by the celebrated naval architect George Sears, the builder of that yacht, in 1851. Her (the *Idaho's*) engines were designed and built by a Mr. Dickerson. They were a new type, and the contract with the government required that the ship should steam fourteen knots per hour, an unheard of speed for steamers in those days. Under the most favorable conditions, she never made more than ten knots per hour, and Mr. Gideon Welles, our Naval War Secretary, ordered the engines and boilers removed, the former to be broken up, and the latter to be placed in another steamer. The *Idaho* was then rigged as a three-masted sailing ship, and wa

to be stationed as a store and hospital ship at Nagasaki, Japan. Immediately after the Civil War we had sent ten fine modern warships to the Asiatic Station, which at that time embraced the waters and coasts from Cape Town in South Africa, to India, Australia, China and Japan.

The changes and alterations in the ship were made at the navy yard in New York. The large "built up" lower masts were allowed to remain in their original places; the ship was heavily and loftily sparred to royals. Her main yard was one hundred and nine feet long. She carried enormous single topsails, and there were thirty-six whole cloths of canvas in her lower square studding sail.

The lower hold, where previously the engines, boilers and coal-bunkers had been, was given up to the carrying of coal and stores. Half of the "between decks" was set aside as a fleet hospital, with fifty iron bed-steads to be installed upon arrival in Japan. During the outbound voyage this deck was filled with various naval supplies, in fact every foot of space was utilized to carry stores to the Asiatic station.

The original cabin, wardroom and steerage on this deck were retained, and were to be used by sick and invalided officers of the fleet. Officers, ordered to the Brazil squadron as passengers, lived temporarily in these quarters, and the midshipmen in the steerage. A small deckhouse, with very limited quarters for the captain and wardroom officers of the ship, was built on the spardeck abaft the mizzen mast. The space on the spardeck, from the straight stem to the foremast was covered with a light deck, thus making a large, comfortable top-gallant forecastle, which housed the entire crew and ships galley.

As a full rigged sailing ship, the Idaho carried a battery of eight 32-pounder smooth bore guns, two 60-pounder parrot rifles, and a crew of ninety-one men. The latter were totally inadequate to handle the ship in a man-of-war style. As a steam frigate with a full battery, her complement had been four hundred men. Our ship had a full list of officers, including eight midshipmen who were especially sent on board to learn seamanship. The present Rear-Admiral C. T. Hutchins, retired, was one of them, and Pay Director G. A. Lyon, retired, and I, are the only officers living of the thirty-two (including the officer passengers) who sailed from New York to Japan in the *Idaho* forty-six years ago.

While the ship was fitting out, many predictions were made that she would never reach her destination. These prophesies were based on the claims that "the ship was too large for a sailing vessel and could not be handled as such; that her masts were improperly stepped; that the crew was insufficient," etc. The latter statement was true, yet we managed very well, "merchant ship fashion." In light winds the ship was "sluggish in stays," and had to be carefully watched. Her foremast should have been stepped further forward.

Strange, as it appeared to us, the naval constructor, kind, genial Mr. Delano, who made all the changes and alterations, giving us those towering topmasts and unusually heavy spars, that caused some qualms until we got used to them, was himself dubious regarding our prospects at sea. Before leaving New York, Mr. Faxon, the Assistant Secretary of the Navy, came on board to inspect the ship; wished us good luck, and hoped we would arrive safely at our destination, of which he seemed somewhat in doubt.

In September, 1867, I was ordered to the *Idaho* as her second watch officer. I frankly admit I was awed when I first stepped on board and saw her enormous spardeck of 375 feet and her lofty masts; but we were all young and ambitious, were proud of the ship, and at sea soon got used to her, for she "handled and worked" like the yacht upon whose lines she was built. At that date, she was the largest sailing vessel (4200 tons displacement) afloat. I have never seen a more handsome or graceful one. Her plans and lines were copied and reproduced on a smaller scale by many maritime nations. In whatever port we lay, our vessel was the principal attraction, not only among the naval and merchant marine, but also to the people on shore.

Leaving New York on the first of November, we soon found that the ship was very swift and carried sail "like a church." During the thirty-four days to Rio de Janeiro, a more than average good passage, we did not have a "reef topsail breeze," and, consequently, could not tell what the ship was capable of with regard to speed.

One afternoon, as we lay becalmed near the equator, in company with several other sailing vessels, the fire alarm was sounded. Seeing the heavy columns of black smoke rolling up from the after hatches, we knew it was not a drill, but the "real thing." I know of nothing more startling or "heart twisting," if I so may

call it, as the cry of fire at sea; the sailor understands its awful danger, but the landsman believes, that with all the water around him nothing is easier than to put out such a fire. I have witnessed three serious fires on board our man-of-war, in one case the coal-bunkers were burning, and for many weary hours, we did not know whether or not the fire had charred a hole through the wooden hull.

The cause of this fire was the breaking of the gunner's lantern in his storeroom, and the consequent firing of the very inflammable articles stored there. The man tried to put it out alone, was nearly suffocated, and it was not until we saw the smoke on deck, that we were aware of the accident. The gunner's storeroom had been built over the after magazine. In the latter was stored more than thirteen tons of powder, which we were carrying to the Asiatic fleet. In those days, in wooden ships, the powder magazines were built on the "keelson." They were constructed of 3-inch pine planks, and lined on the inside with one-quarter of an inch of sheet lead, tightly soldered. As soon as we ascertained where the fire was located, the magazine was promptly flooded—at least we believed so—and felt easier in mind. After a hard fight we extinguished the fire, and found that the deck, and the pine planks of the magazine were badly charred, exposing the lead lining.

I have often noticed, that in the most dangerous and trying experiences, some quaint and ludicrous incident is likely to happen, which one can laugh over when the danger is passed. Our close call of the *Idaho* was no exception. When after an anxious night watch, the order was given to let the water out of the magazine into the bilges of the ship; we noticed, when we entered the magazine, that there never had been more than two inches of water in it at any time. On examination, it was found that the canvas hose attached to the flood-cock had been tightly stopped up instead of being led along the floor for the free admission of the water, and that the few inches of water had merely oozed through the canvas from the outside pressure. No blame for this gross neglect could be laid to the officers of the ship. The magazines, and even its passages, had been filled with full powder tanks by the ordnance department at the navy yard. It had been reported in perfect condition, and was not to be opened until we arrived on the station. The magazine for the ship's battery was in the forward part of the vessel.

Our senior medical officer, a genial, kind shipmate, ready to enjoy a joke at his own expense, got badly rattled during the fire. He took two 20 pound pieces of pork, which had been issued to the ship's cook for the next day "pork and bean" ration for the crew, lashed them around his ample waist, climbed onto the bowsprit, calmly awaiting for the after part of the ship to blow up and hoping, as he expressed it, "the pork would keep him afloat until he was picked up by one of the becalmed vessels near by!"

While in the equatorial latitudes, the captain permitted a boat to be lowered, so that one of our messmates, who was an excellent artist with pen and ink, could sketch the ship. I was a member of that boat's crew. There we saw a huge black vessel on a smooth, green sea, her fine, symmetrical lines, more like a yacht than a war or merchant ship; her broad white-painted stripes increasing her length to the eye, and, on her lofty spars, every sail, including the starboard studding sail, set; to me it was an impressive, beautiful sight. How I wish that kodaks had been invented at that time. Our artist made an excellent picture which was photographed on arrival at Nagasaki, and I treasure a faded copy.

We remained at Rio de Janeiro one month, and met in port our Brazil squadron. Our officer-passengers left us, and sorry we were to part with them; on the trip from New York they entertained us with many laughable, theatrical stunts.

From Rio to Cape Town, South Africa, we made the run in nineteen days, a record never excelled by a sailing vessel. The regular mail steamers schedule was from twenty to twenty-four days. We went south as far as the Island of Tristan de Acuna, experienced very heavy weather which tried the ship severely, disproved the doleful predictions made in New York, and showed to us for the first time how fast she could travel. We did not spare her; the watch officers vied with each other in carrying sail to the last moment of safety.

Leaving Cape Town after a short stay, we set a course for "North West Cape," on the Australian Continent, and made the passage in the remarkably fast time of twenty-one days. We encountered rough rainy weather and heavy seas, but generally strong, fair winds. The largest day's run was four hundred and ten miles. The log line (no taffrail log on board) broke during a squall, when nineteen knots had run out.

In gales, or light winds, no vessel ever passed the *Idaho*. A sail

would be reported by the lookout on the foretopsail yard, and if going in our direction, usually in four to six hours she would be abeam and soon far astern. We purposely would steer very near them and enjoyed their astonishment and admiration shown in cheering us. Frequently we carried topgallant sails, and passed large, strong ships under single or double-reef topsails.

We were surprised to meet so many sailing ships in the Indian Ocean, the majority bound to the eastward and flying the English flag. During our entire voyage to Japan, I do not believe we met two dozen ships displaying the stars and stripes. Even in the latter sixties, two thirds of the world's merchandise at sea was carried in sailing vessels. In many ports in the Far East steamers were a curiosity.

One day we hove to (to make repairs to a sprung yard) under the lee of Saint Paul, a lonely and uninhabited island equidistant from Africa and Australia. A boat's crew was sent on shore to fish in the sunken crater, and also to shoot (for the crews messes) wild pigs and goats left on the island by whaleships who still visited the place at intervals.

Our fair sailing ended upon sighting the Australian Continent. Calms, light head winds, strong westerly currents, were our lot for almost two hot and dreary months. For twenty days we did not make fifty miles on an easterly course. It would have been more advantageous to turn back and go south as was originally intended, through "Bass Strait" around Australia, which would have assured to us a fair and strong wind to the equator at that season of the year.

The north-east monsoons prevented our taking the short route by the way of the China Sea, and in company with many sailing vessels of different nations, among them two fine clipper ships flying our flag, we literally drifted over a hundred miles through "Ombay Strait," the large island of Timor on one hand, Flooris, Pantar, and many other islands on the other. One night, during a calm with a smooth sea, the *Mary Whittridge,* of Baltimore, drifted into the *Idaho* without doing damage to either vessel. Ten years later I saw this celebrated clipper ship with her masts removed, a coal barge, delivering fuel at the Boston Navy Yard. We anchored at the Portuguese port of Dilli on Timor for water and fresh provisions. It was to this place the English had banished many prominent participants of the Indian mutiny.

The passage from Dilli to Nagasaki was very tedious: calms, baffling and light winds, compelled us to go far to the eastward. We sighted the Island of Guam, little thinking that that spot on the far horizon would one day be one of our outlying possessions. After all our remarkable fast sailing at various times, our voyage from New York to Nagasaki, Japan, including stoppages in port, was over five months.

At Nagasaki I was detached and ordered to the double-ender cruiser *Ashuelot*. The *Idaho* was moored opposite the city. The hospital was established on board, and stores were delivered whenever a vessel called for them. The combination of a store and hospital ship was unfortunate. Discharging coal from the lower hold, with men seriously ill on the deck above, did not prove to be a success.

In July, 1869, I returned to the *Idaho*. Orders had been received to send the ship to San Francisco, where she was to be rebuilt and have engines again installed. In August we left Nagasaki for Yokohama with forty men as a deck force. A few days out of port we ran into the tail end of a typhoon, and lost several sails and spars. At Yokohama the crews of the *Maumee*, *Aroostock*, and *Unadilla*, gunboats, which had been sold on the station, their usefulness having passed, joined us, with all the men whose term of enlistment had expired, thus making a total of four hundred men. We were delighted with the prospect, that on our homeward passage, we would be able to handle and work the ship in a regular man-of-war fashion.

Returning home for their final examination, there also came on board Midshipmen W. E. Uhler, C. A. Copp, J. C. Hull, G. K. Adams, and G. K. Brower. Poor fellows, all were drowned in Yeddo (Tokio) Bay on board the steam sloop-of-war *Oneida*, when she was sunk with a large loss of life, January 24, 1870, by the Peninsular and Oriental mail steamer *Bombay*. The latter left the *Oneida* after the collision, never inquiring if assistance was needed.

Prior to 1869, and for many years later, the first teas of the season from China and Japan were carried to Europe, and some to America, in fast clipper ships. In this there was a great competition. The officers always received a handsome bonus for a successful and first arrival at the home port. The English tea-clipper ships *Thermopylae*, *Marathon* and *Elizabeth Nicholson* had, for

years, made swift passages to London. These ships and several others, laden with teas and ready for sea were at anchor at Yokohama near the *Idaho*, and would have sailed sooner, but the marine insurance companies refused to "clear them until the equinoctial typhoon season had passed."

The *Idaho* received orders to go to Hongkong, to take on board the stores left at the abandoned naval storehouse there, and then to sail for San Francisco. The commanding officer, Commander B. B. Taylor, represented to our admiral, Vice-Admiral Stephen C. Rowan, then in port, the status of the tea-clipper ships, and asked to be permitted to remain until they sailed. The admiral thought otherwise, and ordered the ship to leave September 20, which order was obeyed.

The following day we ran into, what was talked about for many years in the Far East, as the "*Idaho's Typhoon*," were dismasted to the lower masts, and came near foundering. For some years this disaster was used as a text at the Naval Academy, for few ships had ever gone through the center of a typhoon or had registered a barometer as low as 27.62.

"The Laws of Storms," simple as they are, were not so well understood in 1869, as at the present day; yet every line officer in our wardroom had been for two and more years on the station, and had had experience with these revolving gales. About 7 a. m., September 21, with little change in the direction of the wind, the latter and sea increasing, and the barometer steadily falling, there was every indication of typhoon weather. It was suggested to heave the ship to, and watch which direction the storm was traveling. Had it been done, we would have left the center far to the eastward. As we had plenty of searoom, it was strongly urged at 10 a. m. "to put the ship on the starboard tack" and run for several hours before it. Late as it was, by the maneuver we surely would have escaped the center of the storm. Our captain, a young commander, was a stranger to the ship and station, was anxious to make a quick passage, and keep up the reputation of the ship for speed; he believed "we would soon out run the gale," and so we kept on our course and steered for the center of the storm.

For the better understanding, and to relate what took place during the typhoon, I will quote at the end of this narrative the ship's log, and its hourly reading of the barometer, also the letter

of the captain to the admiral reporting the disaster. The latter report was a compilation of those submitted by the executive officer, navigator, and the three watch officers. Before it was sent, the captain referred it to these officers, and several modifications were made.

Many incidents, that would no doubt make interesting reading, happened during the storm, but were not recorded in the ship's log book. We were too busy endeavoring to save the ship, and much of the log was written the next day. Critically examined, it may appear contradictory, but to us on the spot, it was clear and could readily be explained. I quote the log book and the captain's report exactly as they were written. Ship's logs of those days were little more than a very abridged statement of occurrences, the commanding officers required them to be so. Two midshipmen were stationed by the navigator to watch the barometers, they were also consulted by other officers, and their reading is correct.

One unmentioned incident came directly under my observation. All boats, with the exception of the third cutter hanging at the davits in the port waist, had been destroyed, or damaged by wind, sea, and falling spars. Midshipman Copp (drowned four months later on the *Oneida*) attempted to pass a hawser around this cutter. He was washed out of the boat, and, not catching the rope I threw to him, he remained for several minutes in the awful sea alongside while the ship was in the vortex of the storm, when a wave picked him up and threw him back on deck. It was more than surprising that, with falling spars and other dangers, officers and men were not killed or maimed. With the exception of several minor bruises, no person was injured during the storm.

At daylight the following morning, the sea and gale having moderated, we began to clear the wreck, and saved from the floating débris some of the broken spars and tacklings. Above the tops, the ship had hemp standing rigging. Fortunately the *Idaho* carried several spare spars, and by working day and night, cutting, fitting, sewing, and making many alterations, using top gallant-masts for topmasts, etc., in twenty-four hours the ship was under "jury rig," carrying topsails as courses, and topgallant sails for topsails.

In this disabled condition, the course was shaped for Yokohama, the ship being not only a wreck in spars and sails, but even more so in her hull and fittings. Decks and outside seams were

wide open, the oakum having been forced out by the straining during the storm. Many chain plates of the lower standing rigging had been wrenched from their fastenings in the hull. The vessel was hogged, her back being broken forward of the mizzen section. She leaked badly, and would have assuredly foundered had she not been built and fastened like all our wooden warships, with broad, iron, diagonal braces, countersunk into the wooden frames. Merchant vessels are not so strongly built, and no doubt this is the reason one seldom hears that such a vessel has successfully passed through the center of a typhoon, or other revolving storms. In the majority of cases, they had joined "The Port of Missing Ships."

A few days after the storm, the new Pacific side-wheel mail steamer *America* (burnt in Yokohama harbor a few years later), crowded with passengers, on her maiden voyage from New York via Cape Town to Yokohama and San Francisco, sighted us, and noticing the disabled condition, came near and inquired if assistance was needed. Our captain sent an officer on board with strict orders "to accept a tow to Yokohama, but not to ask for it." Captain Doane, of the *America*, declined this proposal and, after various interchanges of opinions, he steamed away for Yokohama and reported to our admiral our conditions and whereabouts.

The latter, with the flagship *Delaware*, the *Oneida*, *Iroquois*, *Ashuelot* and *Monocacy*, left port to search for us unsuccessfully and, after a week's cruising, returned to Yokohama. The *Delaware*, having gone farthest to the eastward, met with very rough weather, lost several spars and boats, for all of which, we on the *Idaho* did not feel sorry.

We anchored off Yokohama September 28, 1869. Sailing up the bay before an easterly gale, the good old ship under her jury rig made fourteen knots per hour, as if to show to us for the last time what she could do. She never left the port again. There were no facilities to repair her; it would have required the rebuilding of her hull in a drydock, and as her frames were of green timber, the expense would not have warranted the outlay. She was condemned for active service, and was used as a permanent station ship at Yokohama until 1875, when she was sold to private parties, and used for several years longer as a rice hulk. Later she was broken up.

THE LOG OF THE *IDAHO'S* TYPHOON.

MONDAY, SEPTEMBER 20, 1869.

Barometer.

29.99 Left Yokohama at Meridian.

TUESDAY, SEPTEMBER 21, 1869.

29.97 *Midnight to 4 a. m.* Weather overcast with light drizzling rain
29.97 during last two hours of watch; fresh breeze from N'd. and E'd.;
29.98 clouds, cirrus, cumulus and nimbus; making 10 knots on course. At
29.97 4 changed course to S. W.

R. C. HOOKER, Lieutenant.

29.98 *From 4 to 8 a. m.* First part of watch rain, latter overcast but
29.98 pleasant. Wind strong from E'd, gradually hauling to the S'd, so
29.94 that by 6 o'clock, ship was sharp up on port tack. Set staysail,
29.96 spanker and royals; took them in with the top-gallantsails at 7.40.
Carried away lee-main topsail sheet. Clewed down the topsails to double reef them. Very rough irregular sea running. Ship pitching moderately.

O. W. FARENHOLT, Master.

29.89 *From 8 to Meridian.* Weather pleasant. Fresh gales from S. E.
29.75 Clouds, cirro, cumulus, sea rough. At 8.45 changed course to S. W.
29.74 by S, double reefed the topsails fore and aft and took in jib. Latter
29.70 part more wind with very rough sea.

J. F. MERRY, Master.

29.61 *From Meridian to 4 p. m.* Weather overcast and rainy with stiff
29.61 breeze from S'd. and E'd.; clouds, nimbus, sea rough. At 1,
29.50 called all hands and close reefed topsails; hauled up and furled
29.33 courses. Furled mizzen topsail. Burst new fore-topmast staysail and set fore storm-staysail. At 4 took in and furled fore topsail. Barometer falling during watch.

C. M. ANTHONY, Lieutenant.

29.23 *From 4 to 6 p. m.* Ship laying to on port tack with close reefed
28.18 main-topsail, fore trysail and fore storm-staysail, helm hard up.
27.80 Weather overcast and rainy with gale from S. E. At 4 p. m.
27.72 got up a hawser, and rove it as a preventer main-topsail brace. At 4.30 the gale continued increasing with sudden and powerful gusts which pressed the sea down almost smooth, cutting off the tops of the waves, driving the spray fore and aft the decks and making a great noise; it was impossible at all times to breathe above the weather rail. At 5.15 the main-topsail split with a loud crackling, and simultaneously with this the main yard carried away in the slings, hanging in three pieces by the sail and lifts. Let go the lee brace and threw everything aback. Set the main-trysail and secured the wreck. Main-trysail blew into the ribbons. At 6 p. m. blowing a perfect hurricane with such a fearful howling that it was impossible to be heard at arms length.

R. C. HOOKER, Lieutenant.

27.80 *From 6 to 8 p. m.* Blowing a terrific hurricane with fearful gusts
27.62 from the S. E. At 6 the main-topsail yard went in the slings, the wreck hanging in the lower rigging to leeward. Soon after the fore and mizzen royalmasts went, followed by the main-royalmast and foretopgallant yard. Fore storm sail and fore storm staysail split and blew to ribbons. Attempted to get a tarpaulin in the weather fore rigging, but found it impossible to get on the forecastle. Third cutter was washed from the davits without and preceptible noise; another sea took the whale boat, broke it in two, half going overboard, the other half remaining in the mizzen rigging. At about 7.40 the gale suddenly died away, seas breaking over the ship carrying away, breaking the canopy railing, captains' pantry, armory, forward part of top-gallant forecastle and everything loose around the decks. Secured again the hatches with hammocks; rigged the pumps and attended them well; ship rolling and laboring very heavy in the frightful sea running, which often would break over the ship simultaneously forward and aft, shipping tons of water. Secured the remaining part of main yard and set to work to clear the wreck, the crew working very well. At 7.10 the barometer stook at 27.62.

O. W. FARENHOLT, Master.

From 8 p. m. to Midnight. At 8, lying to on port tack in the vortex of the storm, nearly calm with tremendous high, cross and con-
28.23 fused sea breaking over the ship the same as it would over a half-
28.62 tide reef, causing her to tremble violently and labor heavily.
29.23 Set spanker and mizzen staysail, got tarpaulin and boat awnings
29.99 in the main and mizzen rigging to bring ship head to wind; took in spanker and mizzen staysail soon after, as the wind increased. Main-topmast broke close to the cap, coming down in the lee main rigging. At 9.40 the wind increased, blowing as hard as before entering the vortex. Barometer at one time as low as 27.80, rising rapidly again at midnight, when wind began to moderate.

J. F. MERRY, Master.

WEDNESDAY, SEPTEMBER 22, 1869.

29.89 *From Mid. to 4 a. m.* Weather still overcast, with vivid flashes of
29.85 lightning and showers of rain at intervals, wind blowing a hurricane
29.80 from the N'd and W'd., got awning curtains and tarpaulins in the
29.78 weather riggings. Shipping seas over rails. No canvas set. Mizzen royal fell from aloft and struck the deck. At 1.30 men at pumps to free ship. At 2.15 wind moderated. Barometer rising and sea apparently subsiding. Swiftered in fore rigging to save foremast. Reefed spanker and rove new outhaul. Swiftered in main rigging. High sea running.

C. M. ANTHONY, Lieutenant.

"During rest of day cloudy and overcast with light airs from the southwest, rough irregular sea running, crew employed in clearing wreck and rigging jurymasts; ship standing up for Yokohama."

TUESDAY, SEPTEMBER 28.

Anchored off Yokohama.

VORTEX OF TYPHOON: LAT. 33° 5′ N, LONG. 137° 8′ E.

OFFICIAL REPORT.

U. S. STORE SHIP "IDAHO,"

At Sea September 25, 1869.

SIR: I have the honor to submit the following detailed account of circumstances attending the typhoon of the 21st inst. It has been compiled from observations of the ship's log, and from the personal recollections of the officers of this vessel. The indications of the gale date from 1 a. m. of the 20th, as the barometer was then falling regularly and continued to do so, until it finally started to rise from 27.62—at a time when few of us expected ever again to see daylight. A typhoon was confidently predicted by shore people in Yokohama before we left, and even while we were hove to for the *Ashuelot*, the weather was exceedingly disagreeable, gloomy and threatening; the pilot sapiently declared that nothing would result but a strong northeaster and that we'd get a good start on our course. During the afternoon the sky cleared up brightly, the wind held its direction as predicted by the pilot, and we carried studding sails until the evening. Throughout the mid watch of the 21st the wind continued the same, the ship making 10 knots per hour and at daylight a light drizzling rain set in. During the morning watch the sea became moderately rough, and during the forenoon, the ship began to ride uneasily although the force of the wind remained nearly the same being logged 6, 6, 6, and 8.

At Meridian the barometer stood 29.70. At 1 p. m. the topsails were close reefed (although it was remarked by several officers at the time that we could carry single reefs with top-gallant sails), however, the wind freshened so rapidly that before hands were "piped down," the mainsail and mizzen topsail were furled. At 3 p. m. the foresail was furled, it showing signs of weakness along the head. At 3.30 p. m. the fore topsail was taken in and furled. During this watch a new fore topmast staysail was bent, the fore storm staysail and trysail were set and at 4 p. m. the ship was laying to, on port tack under fore storm staysail, fore trysail and close-reefed main-topsail heading S. W. by S. with a moderate gale from S. E. and drizzling rain. The sea was quite rough but she rode very easily. The barometer stood 29.50, falling rapidly, and the gale was increasing with great violence holding steadily to its direction S. E. until 8.30 p. m.. Between 4 and 5 p. m., a hawser was rove as a preventer main-topsail brace, and stout jumpers were placed in the lower yard arms during the afternoon. After 5 p. m. the gale increased by terrific gusts to a hurricane. The main-topsail was now being made ready for setting close reefed in case the topsail should go. At 5.15 the main yard went in the slings with a thundering crash, the starboard arm banging furiously to leeward against the rail and rigging, breaking in two, one piece falling in the backstays and rigging, the other hanging by the sail, brace, and lift,

until frapped against the forward swifter. The port yardarm flew aback pressing against the weather rigging, which was relieved of strain by taking the jumper well forward and setting it up. Simultaneously with this disaster the main-topsail split with a succession of deafening cracks, sounding like volleys of musketry, and the lee half instantly disappeared, the lee brace was immediately let go, the topsail yard flew aback and the main trysail was set as quickly as possible. This sail did good service for nearly an hour when it finally blew to ribbons. The noise, fury, and impetuousity of the hurricane at this time was indescribable. The prisoners were released at 6 p. m. and worked manfully doing whatever they were told in securing wrecks and repairing damages, too much praise cannot be given to the crew, some of whom toiled like giants. The services of Boatswain Leeds (passenger) were invaluable, in cheering and leading on the men he was at all times the right man in the right place. Several main-top men distinguished themselves by securing the lee main yard arm from crushing in the ship's side. Awnings and curtains were placed in the weather rigging, the ship lay to almost motionless heeling over considerably. The gusts of wind now were sudden and all powerful, their fiendish howl deafening; the air composed of spray. The sea was pressed down smooth, the top of the wave cut clean off by the wind, and carried by the tempest in fine spray that blinded us and stung our faces painfully. At times the mainmast was invisible from the quarter deck, it was utterly impossible even to look above the rail, and below it we actually breathed salt water. Orders could not be made intelligible by word of mouth, the trumpet was useless, and work alone was accomplished by example. Men became sick from salt water which they imbibed, the tempest still blew from the S. E. and continued so until 7.40 p. m. Between 6.30 and 7.40 the following accidents occurred, the main-topsail yard, fore and mizzen royalmasts and yards, main-topgallant mast and yard, and fore-top gallant yard carried away; the fore trysail split, followed by the fragments of the fore-storm staysail, the sheet of which was steadied and strengthened by two strong tackles. The barometer stood at 27.82 when the main-topmast went close to the cap with a fearful crash, coming down with the whole debris of top hamper, starboard half of main top, all of which lodged outside of the lee main rigging.

The wire rigging held wonderfully, the mizzen top gallant yard, after hammering to leeward for some time, strangely thrust itself between the lee rigging and mast and jammed. The wreck of the main-topmast could not be cut away, and the ship began to labor heavily, shipping great seas with every lurch. One of those seas broke the whale boat in two, half of it went overboard, the other half remaining under the mizzen top being kept there by the force of the wind; the sea crushed and carried away the bulkheads of the cabin, top gallant forecastle, armory, canopy railing, skylights, hammock rail and everything loose about the decks. The ship went nearly on her beam ends, but in a moment righted and left the third cutter in the sea to leeward; the barometer had now fallen to 27.62; at 7.10 p. m. A sea came over the lee bow, carrying away and breaking rail and woodwork from forward, sweeping the gangway clean, bringing every-

thing aft; carrying away a second time the ward-room skylight, which was now secured with the cabin carpet, but still tons of water rolled below. The tempest was now as intense as it was possible for it to be, and its fury unimaginable. The darkness was impenetrable except occasional flashes of very sharp lightning, when the waves could be seen banked over one another, seething and boiling, high above and around the ship. The noise was like unearthly yells and the poor ship quivered in every timber.

Suddenly the mercury rose to 28.81 and with slight fluctuation continued to rise, with one fierce squall the tempest dropped almost to a calm and we were in the vortex. A confused cross sea was now runing, while puffs and squalls came from all points of the compass. The ship made water fast, the pumps were manned, the men singing cheerily and congratulating themselves the gale was over. Shipping great seas every instant, and being strained continuously, the seams in the deck opened fore and aft, the water poured through in torrents, damaging and destroying all books, clothing and stores, as well as all the personal effects of the officers in the wardroom and steerage, and the crew on the berth deck. The knees were breaking, bolts and chain plates drawing, stanchions fetching away, planks working, and decks and waterways gasping open. The forward part of the ship appeared to be working independently of the after part. During the calm she shipped a sea on both bows, starboard gangway and both quarters at the same instant, the decks were full of water and the ship trembled in the shock as if she would never rise again.

Expecting now the other half of this fearful gale, tarpaulins were now secured in the rigging, hatches rebattened, close-reefed spanker gotten ready, wreck cleared and secured, and at 9.20 the wind came out with redoubled fury and violence from the N'd. and E'd. striking us on the port beam. The ship bore up well and laid more quietly than during the first part of the typhoon. The wind backed to the N. W. and moderated rapidly, still the sea was very rough and the ship rolled fearfully when the wind went down.

This has been my personal recollection during this fearful and disastrous typhoon. Old sailors in the ship, some of whom have followed the sea for fifty years, say they never saw it blow so hard, and certainly it appeared impossible that it ever could have blown harder. I cannot close this report without again praising the excellent behavior of the crew, who worked as orderly and cheerfully as if in a top-gallant-sail breeze.

Very respectfully,

B. B. TAYLOR,
Commander, U. S N.,
Commanding.

THE COMMANDER-IN-CHIEF,
U. S. ASIATIC FLEET.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MOBILE ARTILLERY IN ADVANCE BASES.

By MAJOR HENRY C. DAVIS, U. S. M. C.

All of the present arrangements for the defense of Advance Bases contemplate the use of some form of Naval Artillery as a part of the plan of defense.

The theory is excellent, to oppose attacking artillery with guns of equal or nearly equal power.

If, however, the Advance Base is to be at all mobile, and it is conceded such bases *must be mobile,* then some other form of artillery must be used. At least it must supplement the semi-permanent mounts and guns of the present outfits.

In the places contemplated in the different schemes of defense gotten up by various boards appointed for the purpose, no attention has been paid to the fact that such places are to be defended by anything other than troops and the naval guns which these different boards have recommended.

These guns range in caliber from the 3-inch semi-automatic to the 6-inch R. F. rifle. The platforms which it is contemplated to be used for the mounts of these guns are to be put in selected places, defending points at which it is thought most likely the enemy will land his raiding party. There they are stuck, and, of course, in the present day their location will not be a matter of secrecy very long, and in any case, that because the most likely spot for a landing is guarded, is the best reason for the enemy not coming to it. One cannot make plans too far ahead in warfare.

These guns are permanently located or they are semi-permanently located, in either case we lose their use at any place outside their arcs of fire. They cannot be used for defense on the landward side of the work they occupy, and they are a terrific strain on the personnel which places them in position as in the Naval service the personnel of the defense is to be used to place its guns.

In addition to this strain of getting guns, weighing as high as six tons, from a ship or transport, there is the greater strain of handling them on shore by man power assisted by such blocks and tackle as are sent along or at hand.

Even the most rapid and untiring work on the part of the men engaged will not compensate for the time lost with such a type of gun; nor will its power be so much in excess of a more mobile type as to make the trouble of placing it worth while.

It seems beyond doubt that the mobile gun, which means a gun with a carriage not so heavy but that it can be hauled around by man power, is the gun we must have for our advance bases.

What should this gun be? It took from ten to fourteen yoke of oxen to haul around the 4.7-inch gun used by the English in the South African war; and yet we have guns heavier in weight and no more powerful which we are to use in our landing operations and our advance base work, and which we, so far as I am able to find out, are to haul about by man power.

It does not enter into our scheme of advance base work to transport a gun for any such distances as this English gun travelled in the Boer war, but it is possible that a landing operation from the fleet may take a gun, from necessity, much further than is thought at the time of landing. We must have, therefore, a type which can be handled by some motive power which is easily transported on the ship or the transport which carries the gun and its limber.

The fire department of the city of New York are about to fit out their old horse-drawn engines with a tractor which has been perfected by an automobile expert by the name of Christy. This tractor is the solution of the rapid transport of heavy vehicles which are not outfitted with an engine as an integral part of the vehicle.

By means of a modification of the fifth wheel, the front wheels of the engine are removed and the tractor placed. The space taken up adds very little to the original length of the engine and the speed and power are greater than they got out of the three horses which formerly pulled the same machine.

One of these tractors fitted to the front wheels of the present 5-inch gun and limber will haul it any place horses can haul it, will take it there faster and will not be placed out of action by having its horses shot down.

Does it not seem that some such scheme as this gives a very easy and logical solution of the otherwise impossible problem of

providing an ever-ready method of transportation other than that supplied by the men?

There is ample room to store this or a similar type of tractor on board ship; or even two of them. They occupy only half of the space which a 3-inch field gun and carriage occupy.

The use of such a machine means also that stores and such things as are needed by a force on shore can be hauled from the wharves by some other means than by man propelled carts.

Certainly it is well worth the trial. Fitted to a gun as heavy as the 5-inch field gun we have an ideal gun for advance base work. A gun which can very easily take the place of the present 3-inch gun, and which will be more than twice as useful for landing and advance base work, *but such a gun must have power to move other than that supplied by the men.*

There is a case in the author's mind where guns are being placed for the protection of a harbor which may some day be used as an advance base. These guns are set on platforms of 18 x 14 x 18 timbers and the whole is set in a concrete bed. The guns were transported *six miles by man power assisted by block and tackle.* They were 6-inch guns and when placed offered no better defense than a mobile howitzer would have given, in fact not as good, because they *were placed,* and could only shoot towards the open sea.

Suppose an enemy had made a landing on the opposite side of the place these guns were in position? There is no means by which they could be used in their own defense, whereas, with mobile guns, they could be concentrated into a battery which would play havoc with any land attack approaching them.

In addition to the fact that a mobile gun could be rapidly taken from place to place when needed, they can be more easily concealed than a permanent gun mount, and they can be concentrated when needed, a feature which has been entirely overlooked in the case above mentioned where four guns are widely scattered.

It does not require a very profound knowledge of tactics to realize that a such a wide separation is faulty and more particularly when the widely separated guns form the only artillery defense at present provided or contemplated.

But we cannot confine ourselves to one case. It is none the less true, however, that the same principle holds in all cases. *Permanent artillery defense must have mobile artillery for its defense as well as infantry. The minute we contemplate the use*

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With such a target as a modern gun emplacement makes, an with our knowledge of the quality of marksmanship of the navie of the first class, a gun or two of the type now used could not hop to do anything against a ship. The ship, on the other hand, could stand out of range and make things very warm for the crew of the gun mounted, as it would necessarily be, for advance base work.

Guns in permanent or semi-permanent positions could not keep small craft from coming in close enough to cut cables or shoot up store houses, etc., because their fire could be kept down by the heavier guns from the protecting ships. Mobile guns of a sufficiently heavy caliber could do this because they could change their position or, as stated before, could use indirect fire, and not expose themselves. The wonderful work done in the present day with this indirect fire must not be forgotten, and the observers would not want a better place to observe the fall of their shells than the water of harbor in which all the distances are accurately known.

At the battle of the Yalu, in the Russo-Japanese war, the Japanese concealed in one night seventy-two field guns and twenty howitzers from the Russians, and the Russian batteries which were conspicuously placed, were put out of action in thirty minutes. No target could be more conspicuous than boats loaded with men attempting to land, and nine out of ten guns of the type used at present for advance base work are by reason of their mounts very conspicuous.

Field guns or howitzers could be concealed from the ships supporting the landing and would, if efficiently served, put out of action any landing party, while the chance of the landing being effected is much more probable if we have to rely solely on guns placed in permanent positions, guns lacking mobility.

It is not the purpose of this article to decry the use of guns of a type requiring a semi-permanent mount, nor does it enter the author's thought that such guns are not needed, but to make these immobile guns efficient *we must add to their defense guns of a mobile type.*

We must bear in mind the fact that an advance base for the use of the navy will probably be seized in a night or a day. We cannot waste the time in getting the ponderous naval guns off the ships making the seizure. We must have guns designed for the purpose and they must be fitted so that when the work of assembling them and getting them off the ship is completed, work which would be assisted by all the mechanical apparatus on a warship, they can be run by their own power to their positions. We must not call on men, who will probably be needed on the ships, to go off on such an expedition as dragging a dead weight of five or six tons various distances over unknown country.

We must have guns which can be rapidly moved from one place to another, guns which are not tied down when in place and useless except in a very limited arc of horizontal train.

The design of the naval ship's gun is against it for this work. The extreme elevation for which they are generally designed is fifteen degrees, and it is quite likely that we will want to use a still greater elevation to accomplish anything with indirect fire.

If our contemplated naval bases in the Pacific are isolated by having the cables cut, and if we are to be in ignorance of their fate in the event of war until some news can be gotten by our scout cruisers or other fast ships, we must certainly give these

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If guns of this type are to be used, then we must assuredly add to the outfits for advance bases mobile guns and the means to make them *mobile in fact as well as in name.*

Even if we have no other means of transporting these guns than that supplied by the men of an advance base force, we must none the less *have the guns* and hope for the powers that be to give us some means of getting them about, which is practical for a naval outfit. Draught animals do not provide such a means for us for the navy, and so we come to the question already mentioned, either an automobile gun or a tractor to be used with the guns we need.

The naval guns at present used in the advance base work are not placed in their positions for use against the artillery of a fort, but are to be used against the landing parties from a ship. This work can be done in much better style by a mobile gun for two reasons; first, the attacking ships will not know the location even approximately of such guns, and secondly, such guns can do their work and get away after exposing their position, or they can use indirect fire and not be located at all by the enemy.

With such a target as a modern gun emplacement makes, and with our knowledge of the quality of marksmanship of the navies of the first class, a gun or two of the type now used could not hope to do anything against a ship. The ship, on the other hand, could stand out of range and make things very warm for the crew of the gun mounted, as it would necessarily be, for advance base work.

Guns in permanent or semi-permanent positions could not keep small craft from coming in close enough to cut cables or shoot up store houses, etc., because their fire could be kept down by the heavier guns from the protecting ships. Mobile guns of a sufficiently heavy caliber could do this because they could change their position or, as stated before, could use indirect fire, and not expose themselves. The wonderful work done in the present day with this indirect fire must not be forgotten, and the observers would not want a better place to observe the fall of their shells than the water of harbor in which all the distances are accurately known.

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We must bear in mind the fact that an advance base for the use of the navy will probably be seized in a night or a day. We cannot waste the time in getting the ponderous naval guns off the ships making the seizure. We must have guns designed for the purpose and they must be fitted so that when the work of assembling them and getting them off the ship is completed, work which would be assisted by all the mechanical apparatus on a warship, they can be run by their own power to their positions. We must not call on men, who will probably be needed on the ships, to go off on such an expedition as dragging a dead weight of five or six tons various distances over unknown country.

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At the battle of the Yalu, in the Russo-Japanese war, the Japanese concealed in one night seventy-two field guns and twenty howitzers from the Russians, and the Russian batteries which were conspicuously placed, were put out of action in thirty minutes. No target could be more conspicuous than boats loaded with men attempting to land, and nine out of ten guns of the type used at present for advance base work are by reason of their mounts very conspicuous.

Field guns or howitzers could be concealed from the ships supporting the landing and would, if efficiently served, put out of action any landing party, while the chance of the landing being effected is much more probable if we have to rely solely on guns placed in permanent positions, guns lacking mobility.

It is not the purpose of this article to decry the use of guns of a type requiring a semi-permanent mount, nor does it enter the author's thought that such guns are not needed, but to make these immobile guns efficient *we must add to their defense guns of a mobile type.*

We must bear in mind the fact that an advance base for the use of the navy will probably be seized in a night or a day. We cannot waste the time in getting the ponderous naval guns off the ships making the seizure. We must have guns designed for the purpose and they must be fitted so that when the work of assembling them and getting them off the ship is completed, work which would be assisted by all the mechanical apparatus on a warship, they can be run by their own power to their positions. We must not call on men, who will probably be needed on the ships, to go off on such an expedition as dragging a dead weight of five or six tons various distances over unknown country.

We must have guns which can be rapidly moved from one place to another, guns which are not tied down when in place and useless except in a very limited arc of horizontal train.

The design of the naval ship's gun is against it for this work. The extreme elevation for which they are generally designed is fifteen degrees, and it is quite likely that we will want to use a still greater elevation to accomplish anything with indirect fire.

If our contemplated naval bases in the Pacific are isolated by having the cables cut, and if we are to be in ignorance of their fate in the event of war until some news can be gotten by our scout cruisers or other fast ships, we must certainly give these

bases the means of defending themselves against anything less than an army of invasion. They must be provisioned and equipped with all the munitions of war likely to be needed in a siege, and we must above all *give them the means to make even, an attack by a small army, a thing of very serious aspect to the enemy. A few guns or many guns which are put down in permanent positions will not accomplish this end. They must have mobile troops, and above all, mobile artillery, because the most powerful battery in the world is helpless in the face of a successful land attack. The rear is a very weak place in their armor.*

No determined commander has ever been prevented from entering a harbor by the mere presence of coast defense guns, and no commander worthy of the name ever will be. And once he is in past the defending forts the harbor and all it contains is his. But with a land force backing up the coast defenses, the commander is rash indeed who will undertake to ignore its presence and run past the guns. Only defeat awaits him, unless he has his own army to occupy the army of the defenders.

It is not presumed that any naval defense of an advance base will go into the larger operations of war where armies are concerned. Their defense must be a part of the training of the military branch of the navy, the Marine Corps, and in this training we must consider that the service in time of war will be one which must be rendered quickly, efficiently, and we almost say silently. To do this we must have the most powerful means at our disposal considering the peculiar conditions under which we will have to work, and one of the things which will add greatly to the efficiency of our men will be to provide them with an efficient mobile piece of artillery for this special work.

Brief though these thoughts are, I will now leave the subject, but I feel that it cannot be done without making a powerful appeal to the powers at the Department to design and put into service for this most important work of advance base defense, the *mobile gun* we need. It may have been done but it is not within the knowledge of the writer.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON SIGNALS FOR USE IN HYDROGRAPHIC SURVEYING.

By CAPTAIN A. RUST, U. S. Navy.

As the rapidity with which a hydrographic survey can be conducted depends largely on the time saved in building the signals for extending the triangulation and controlling the hydrography, after two years test I have found the steel towers described herein vastly superior to the wooden signals in common use and employed at first by me, for the following reasons:

(a) They are more economical; for not only is the first cost less than that of wooden signals of the same size, but as they are made of galvanized steel, the large towers having composition bolts and nuts ten feet above the bottom, they will last indefinitely with proper care, and may be readily taken down and set up at other stations.

(b) There is a great saving of time and fewer men are required. A 60 foot steel signal tower may be put together, erected and decorated in one day, whereas a 60 foot wooden tower will take a week under the conditions usually met with, including the time taken to cut and fit the timbers.

Boatswain Thomas James, U. S. Navy, in charge of a party, erected, guyed and decorated a 60 foot steel signal tower on a sand shoal and the party was on its way back to the ship in 5½ hours. This is the best time ever made, I believe, though the work was done under most difficult conditions, the shoal being awash at the time.

(c) The steel signals are not disturbed by fishermen or the natives on shore as the wooden ones are liable to be.

(d) The small steel signals 30 or 40 feet high may be placed on shoals where the water is too deep to erect wooden signals.

(e) The steel signals may be made sufficiently rigid to support the transit directly without an interior instrument stand when

occupied, though when the distances are very great a small tower may be erected inside the large one for an instrument stand.

(f) The steel signals are not so liable to be blown down, as the planks and canvas put on for making them visible at long distances being structurally weak, will blow away first, provided the signal be properly guyed, but in case these steel signals are blown down they are not injured to any great extent, unless there are rocks or stumps for them to strike in falling. It is difficult to guy up tall signals located on sand bars so they will stand a heavy wind and sea, and four 60 foot signals thus placed I found down at the beginning of the next season but practically uninjured. Some of the angle irons were bent but the blacksmith straightened them again in a short time.

Four sizes of signal towers are used by the Cape Cruz-Casilda Survey Expedition: 30 and 40 foot tripods and 60 and 80 foot 4-post towers. The 60 foot tower is shown on Drawing KD-58 furnished by the Aermotor Company, 12th and Rockwell Streets, Chicago, Ill., the firm which furnishes these towers. (See Fig. 1.) The 30 and 40 foot towers have 2-inch pipes at the top to admit a galvanized pipe for a flag-pole. Experience shows that these are more convenient than the heavy wooden poles. The upper ends of these 2-inch pipes should be threaded in order that a brass casting, which is portable, may be screwed to this pipe to which a wooden platform is attached to support the theodolite. I have been informed by the builders that a 3-inch pipe is the smallest that can be used with the 60 and 80 foot towers, therefore to the 3-inch pipe should be screwed a reducer into which a short piece of pipe the same size as that used for the 30 and 40 foot towers should be screwed and threaded on its upper end to receive the portable casting supporting the instrument.

To recapitulate:

(a) In ordering these towers specify for the 60 and 80 four post towers that they be fitted with 3-inch pipes at the top with reducers, and a short piece of pipe the same size as that used for 30 and 40 foot tripods, and be threaded at both ends with standard pipe thread and screwed into the reducer.

(b) Specify for all towers, 30, 40, 60 and 80 foot, the angle irons connecting the bottoms of the anchor posts are to be furnished as shown on Drawing KD-58.

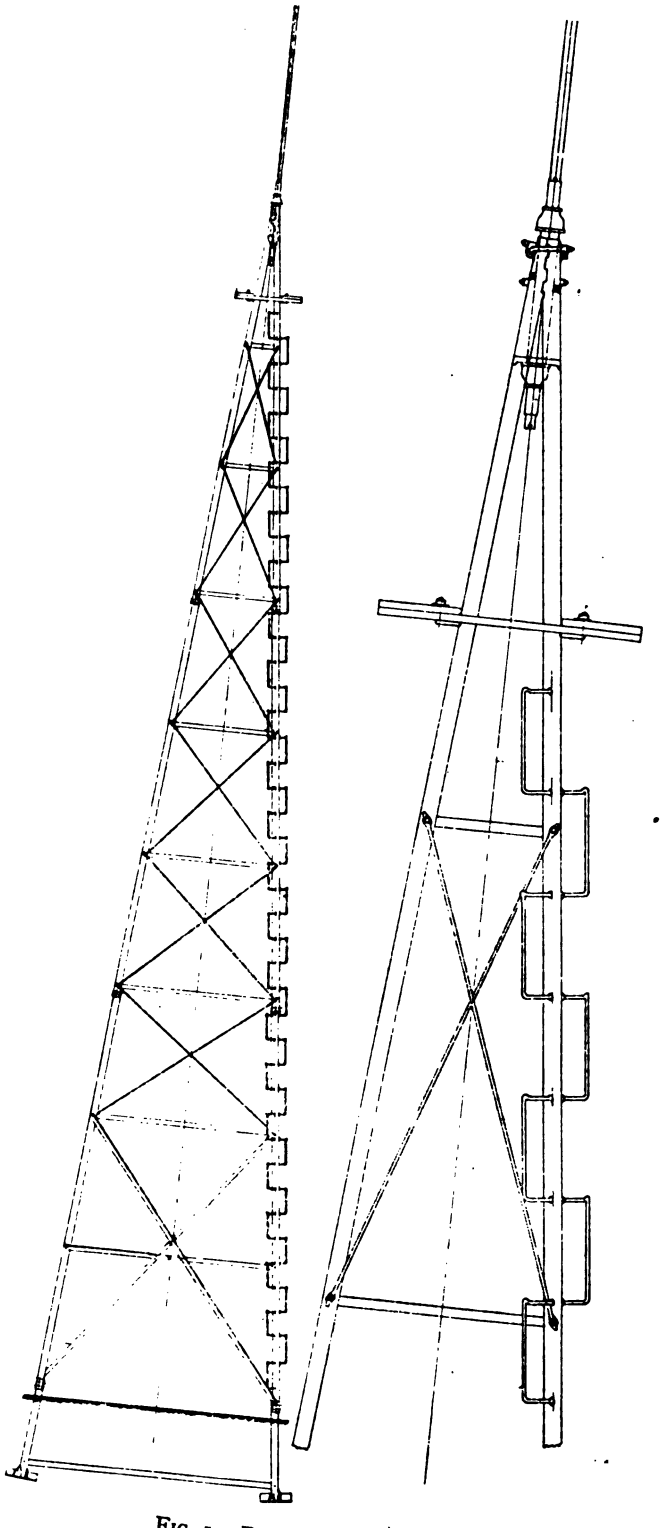


FIG. 1.—DRAWING KD-58.

(c) Require that all parts be so lettered or numbered that the towers may be readily assembled by the drawings furnished.

(d) The required distance from the end of the pipe to the platform which is most convenient for the observer with the transit should be given and the makers required to fit the platform at this distance.

(e) Furnish pipes for flag-poles.

To assemble the 60 and 80 foot towers.

These are furnished in sections 20 feet long. The parts of each signal should be kept made up together in bundles, each section by itself, check out all bolts and lay the bundles in order. The upper section with the head is first assembled. This may be done on board ship and then landed on a catamaran made of two boats lashed to spars. Pick out a level place far enough from rocks or stumps to enable the tower to fall clear in case it is blown down. Lay the upper section down with the ladder up and complete the tower by adding to the bottom of the upper section and attach the steps for ladder. Secure the platform in place. For assembling these towers about a dozen double open-ended wrenches are needed to take ⅜ and ¼-inch nuts. Sometimes, where there is room on deck, time may be saved by assembling two sides of a tower first and completing it on shore. This is the method recommended by the builders, who will furnish printed instructions in detail for assembling and erecting these towers if requested. As a rule it will be well to adopt one method and stick to it, as in this way the men soon acquire the knack of putting the towers together very quickly.

To erect a 60 or 80 foot tower.

In order to give the tower sufficient rigidity for up ending, secure pieces 2 x 4-inches with wire to the corner posts from the bottom of the tower to the platform, AB, CD, also secure two struts 2 x 4-inches diagonally on each side from top to bottom of the lower section as shown at ED in Fig. 2.

It is thought that with the new towers fitted for pipe flag-staffs, as these will be so much lighter than the wooden ones, that the 2 x 4-inch, AB, CD, will not be needed, but only the struts ED. Without the struts ED there is danger of buckling the tower when hoisting it to a vertical position.

Gear required to erect a 60 or 80 foot tower.

(a) A pendant 20 fathoms long made of wire rope 2 inches in circumference, fitted with a thimble in the lower end and stout sister hooks in the upper end.

(b) A tackle 50 fathoms long of 2-inch Manila rope, with a steel 3-fold upper block, steel double lower block, standing part made fast to lower block and hauling part through a steel snatch block, the men walking away from the signal while erecting the same. Chief Boatswain James Glass, U. S. N., found after some experiments that the above gear was the best. This tackle should be unrove when not in use, and the blocks washed with fresh water, dried and oiled.

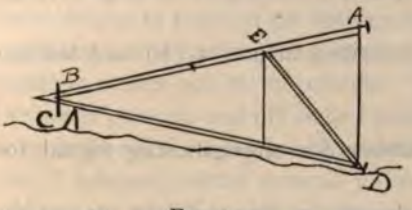


FIG. 2.

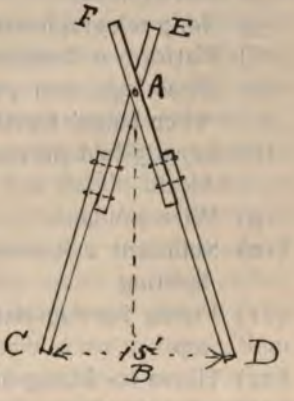


FIG. 3.

(c) Shears. These should be made by bolting two pieces of 4 x 4-inch together for each leg, the parts overlapping well, spread the heels about 15 feet apart and make the altitude of the triangle ACD,AB—35 feet. Bore a hole through each leg and put a stout bolt at A leaving a good crotch FAE, which should be well rounded out at the bottom and be well slushed, or chocks with rounded scores be secured to the legs. Nail temporary braces to the shear legs, and also place a lashing at A in the large angles.

(d) Planks and stakes at the foot of the tower. With the steel angle irons connecting the anchor posts, long planks should not be needed at the base of the tower, but to prevent the tower from skidding, it will be well to drive old boiler tubes or stout stakes near the lower anchor posts as the tower lies on its side, and to take loose lashings around the stakes and these posts, and if

the lumber can be had it is well to bolt short pieces of heavy plank, 3 x 12-inches to the foot of each anchor post to prevent the legs sinking into the mud or sand when the ground is soft.

List of articles required to erect a 60 or 80 foot steel tower.

(1) 2 heavy mauls or sledges.
(2) Stakes or old boiler tubes. A supply of tubes may generally be found at any Navy Yard and they will be found very useful.
(3) Frame work of the signal made up in bundles, each section to itself, and carefully checked up by the blue print, and tagged.
(4) Box of bolts.
(5) No. 7 telegraph wire for guys.
(6) Platform with lumber for enlarging same if necessary.
(7) Shear legs, four pieces 4 x 4-inches, 40 feet long over all when bolted together.
(8) Long 3-fold purchase, described in par. 5 (b) and leading block.
(9) Wire pendant.
(10) Sufficient 2 x 4-inch lumber for strengthening signal for hoisting.
(11) Piping for flag-staff of the proper size to fit the pipe at the top.
(12) Horse for lifting head of signal tower for first pull.
(13) 2 heaving lines.
(14) 4 machetes.
(15) 2 axes.
(16) Hammers, nails, and all wrenches available.
(17) Planks, old canvas, paint and white-wash, if signal is to be decorated, also small stuff for stops.
(18) Flag and halliards.

N. B. Muster all tools before shoving off, and have a station bill for the party and hold each man responsible for providing and returning certain tools and gear.

To erect the 60 or 80 foot towers.

Great care must be taken to have everything rigid and well braced in order not to buckle or drop the tower when it starts from the ground. When the ground is soft or sandy take the strap for the lower block of the tackle around a spar in front of which stakes or old boiler tubes are driven at an angle, drive a second

row opposite, and lash the stakes or tubes together as shown at AB, Fig. 7. Sometimes it will be found convenient to use a steamer's anchor and back it up in the same way. Lift the head of the tower from the ground and rest it on a wooden horse. Take the end of the pendant around the tower just below the platform and hook the sister hooks around its own part and mouse them well. Hook lower block of tackle to a strap taken around several boiler tubes or stout stakes driven well down, well backed, and placed as far from the head of the tower as the length of the tackle when overhauled will allow. Place pendant in the crotch and upend shears and place the feet near the bottom of the tower, but far enough away for the head of the shears to cant a little towards the head of the tower. Get a good strain on the tackle and see that everything is well secured. Attach two guys leading off at angles of about 45° from the tower to stakes in the rear. Drive stakes in front of the bottom angle iron* to prevent skidding, and bend a line to the shear legs to prevent them falling when the pendant comes out of the crotch. This line should be tended as the tower goes up, and the shears eased down by it. When the tower is up it should be well guyed by a sufficient number of guys made of No. 7 telegraph wire secured to old boiler tubes or stout stakes and set up with Spanish windlasses. At least eight guys will be required for these towers. The telegraph wire is better than wire rope or strand, as not only is it not so liable to be disturbed by the fishermen and natives on shore, but the guys made of several parts may be more easily set up taut. The guys should be secured near the top of the signal, just below the platform is a good place, so as not to interfere with hoisting the planks for decorating the signal to make it visible. Anchor stakes should be driven at each corner and secured to the anchor posts by wire lashings. To make the tower rigid for occupation, wire diagonals should be put in between the legs and set up with Spanish windlasses. Procure 24 planks each 16 feet long, 6 inches wide and ½ inch thick, and 6 pieces 2 x 4-inches, about 16 feet long. Nail 12 of the 6-inch planks at right angles to 3 of the 2 x 4-inch, spacing the 6-inch planks about 2 or 3 inches apart (not more than three inches). If the signal is to show against the sky, paint these planks black, if against the land, use the white paint or white-wash. Carry

*Lash a stout spar to this angle iron from corner post to corner post, or to the anchor posts, for these stakes to bear against.

a tackle to the top of the signal, bend on the frame work so that the 6-inch planks will be vertical, bend on tripping line and hoist away and secure the frame-work close up under the guys on one face of the tower, and the other at right angles to the first one. We thus have an area 16 feet square visible 10 miles with the naked eye.

Flags in a region of variable winds are very unsatisfactory, but it is necessary to use these until the occupation of the signal has been completed, when beacon heads made of planks 6 x ½-inch, and from 8 to 12 feet long placed on the flag-staffs were found very good. Another very good decoration for the top of a signal in place of a flag, and one that can easily be removed, if necessary to occupy the signal, was a canvas rig which was made like an old fashioned navy target with three wings making an equilateral triangle of 21 feet on a side from any direction. These wings are spread out by riggers nailed to the platform. A large supply of old canvas should be carried which should be painted or white washed when used instead of lumber for decorating signals.

Lowering and transporting 60 and 80 foot signals.

Before lowering these it is necessary to rig the wooden frame work and diagonals used in erecting the signal, otherwise the legs are liable to buckle, the tower dropped and more or less injured. To transport the 60 and 80 foot towers it is necessary to take them apart except the top section which need never be disturbed, but brought off on a catamaran made of two boats and be triced up along-side or hoisted on board ship.

Erecting 30 and 40 foot signals.

The 30 and 40 foot steel tripods may be easily put together in the gangways on board ship and be triced up alongside, three or four each side. These need never be taken apart when once on the working ground. They are sent ashore on two boats with spars lashed between and may be erected and decorated in a couple of hours, and are very convenient for use on shoals where the water is smooth and from 6 to 8 feet deep, provided the bottom is of such a nature that long stakes may be driven down to which the guys may be made fast.

By using the steel signals in place of wooden ones the amount of work done by a given party in a given time may be trebled.

Floating signals.

For off shore soundings where the water is shoal enough to moor or anchor them securely, excellent floating signals may be made as follows:

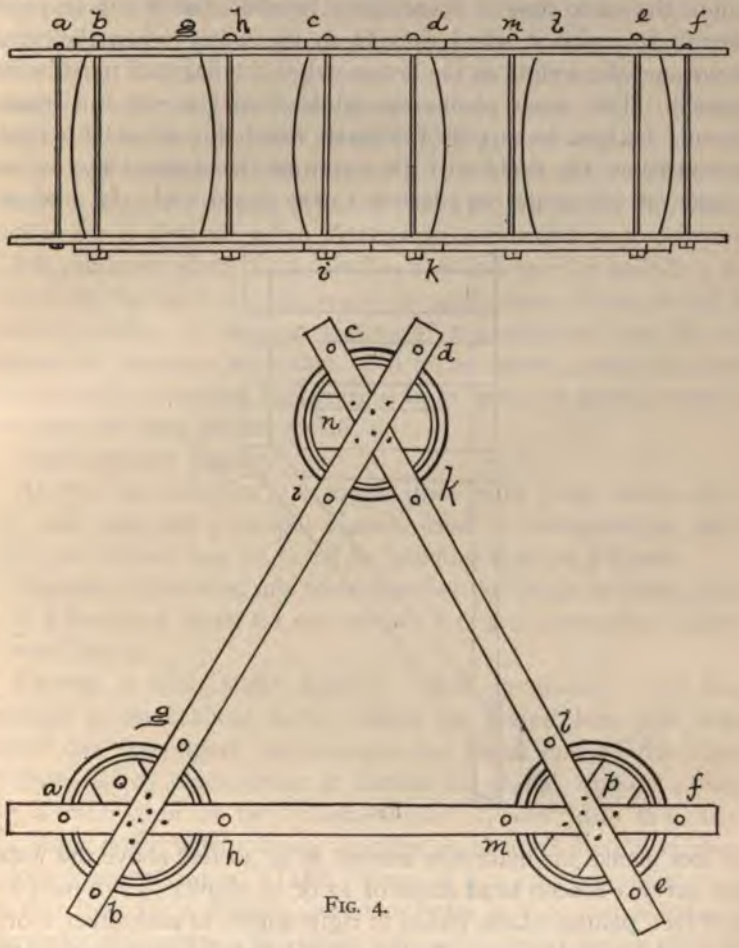


FIG. 4.

Procure three empty barrels, test them to see that they are perfectly tight. Make two equilateral triangles of planks 2 x 6 inch x 12 feet long, place the three barrels between these at the vertices of the triangles, and secure the triangles together by six bolts made of ½-inch iron rod, a, b, c, d, e, f. If these bolts do not seem to make the structure sufficiently rigid for rough water, use six more at g, h, i, k, l, m. Filling pieces, n, o, p, for the heads

of the barrels should be fitted to prevent the barrels working adrift. If the barrels are placed close together the signal will be more suitable for use where there is much wind or sea, and will at the same time be more easily handled, but it will be more difficult to make it stand upright in the water when the wind blows, and the weight at the lower end of the flagstaff must be increased. Two stout planks should be bolted across the frame, top and bottom, to support the mast, which should extend 15 or 20 feet below the surface of the water and have about 150 or 200 pounds of old grate bars lashed to the lower end. If made of

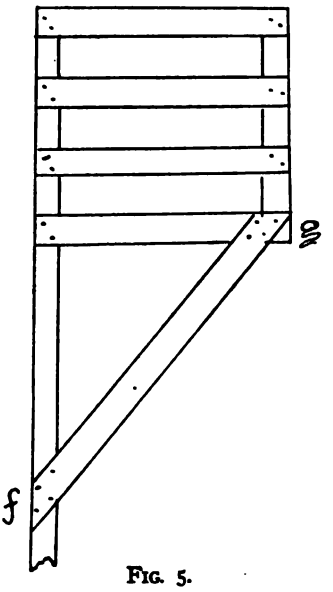


FIG. 5.

12 foot planks the mast may extend 25 or 30 feet above the water and carry a beacon head made of 12 or 16 planks ½ x 6-inch x 6 or 8 feet, painted black, nailed at right angles to each other 6 or 8 on a side, with the space between filled in solid with black cloth. This increases the visibility very much. Three triangular wings may be secured below this like an old fashioned navy target. A strap of wire rope or chain should be secured around the flag-pole above the upper part of the platform to which the anchor chain is secured with a pelican hook moused with wire. The mast should be made of two pieces of 3 x 4-inch or 4 x 4-inch bolted together. It will be found that by placing the barrels tangent to each other,

or nearly so, that the float may be more easily handled, but then instead of a beacon head it will be found necessary to modify this by pacing all the planks in one plane only and nail them to the flag-pole as shown in Fig. 5, otherwise in a fresh breeze the signal will list over so far as to lose much of the height of the mast. This signal will stand upright and show up well except when the observer is directly to leeward or to windward. Weave black cloth in between horizontal planks. Nail a vertical plank ½ x 6-inches to the horizontal planks, and at the lower end of this plank secure a brace to the flag pole, see f and g. To render this signal visible for a distance when directly to windward or to leeward, a few pieces of plank ½ x 6-inches x 8 feet may be nailed to the bottom of the mast at right angles to upper ones; these should be painted white. A regular system of triangulation may be extended off shore on soundings with these signals, occupying each in turn with a sextant, and cutting in as many as possible signals on shore or those on the shoals.

Hydrographic signals.

As it is not necessary to locate these with great accuracy, as the case with the principal signals used in triangulation, much time and lumber may be saved by building them as follows:

Signals of this kind are recommended on shoals in water from 6 to 8 feet deep when for any reason it is not convenient to erect a steel signal.

Provide a stout stake about 6 inches in diameter and long enough to stick about 6 feet above the water, bore two holes about one foot apart and sharpen the lower end of the stake. If there is too much water to handle the signal without a boat, rig a catamaran of two boats, anchor it, and from this drive the stake down with a heavy wooden maul until the top is about a foot from the water. Take a piece of 4 x 4-inches about 15 or 20 feet long for a derrick, bore two holes in it to match those in the stake and secure a tail block with a line rove through it to the other end, or better still put a sheave in the upper end of this spar.

Provide two long ½-inch bolts long enough to go through the upright for the signal 3 x 3-inches, or 4 x 4-inches, the stake and the derrick of 4 x 4-inches, put a bolt through the three as shown in Fig. 6, upend the derrick, and put the other bolt through from the opposite side of the stake. Bend the line to the mast at a distance from the first bolt to the center of the sheave in the derrick.

Nail on the cross planks ½ x 6-inches x 8 feet and weave the cloth in to fill up vacant spaces which should be tacked on with plenty of battens to hold it, take the wire around for the guys, and hoist the beacon upright and after securing the guys unship the derrick and secure the heel of the mast with the second bolt.

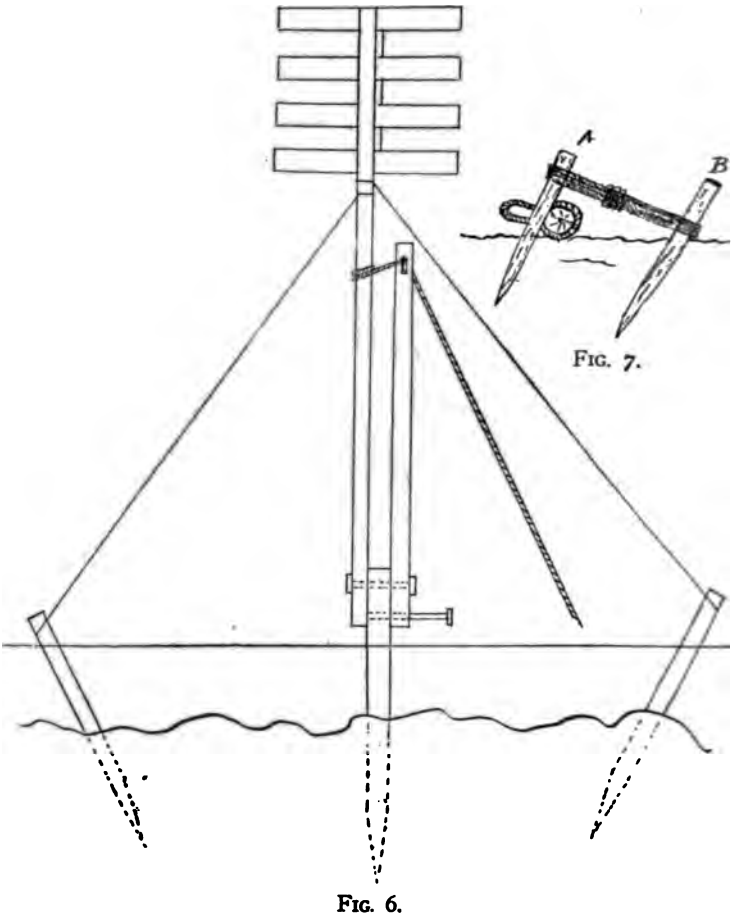


FIG. 7.

FIG. 6.

The black beacon head made solid with cloth makes a fine signal on water, and shows up well against the sky; when a single pole signal like this is used on shore with trees or bushes as a background, a white beacon or three triangular wings hauled out by means of the guys makes an excellent signal and one that may

be quickly built. On shore a hole may be dug to hold the lower end of the mast instead of the stake. These signals have been described to the smallest details, as experience shows that much time may be lost by the signal building parties in trying unnecessary experiments, and thus greatly retard the work.

When prominent trees or hummocks are used for signals they should be marked by beacons or flags to distinguish them before they are cut in. A piece of 2 x 4-inches, or a pole cut in the woods with boards nailed across at right angles to form a beacon with a flag above or below is a very good distinguishing mark. Empty flour barrels white washed or painted black make good marks. As each hydrographic signal is built it should be occupied with a sextant even though a transit be used later, and all signals in sight from it cut in, a regular angle book being always carried for recording these angles.

In erecting signals for the control of the hydrography it is well to remember that it is better to have too many signals than too few. The soundings are delayed very much when the steamers are compelled to stop work to build signals.

Marking centers.

The center of a tall signal cannot be accurately located with a plumb bob if there is any breeze, so as a rule it is better to use a transit. Set up, level, and bisect the flagstaff, and line up two pegs so that the center is between them. Shift the transit so that a line to first pegs will be at right angles, or nearly so, to the first line, and line up two more pegs in the same way, and with cords connecting the two pairs of pegs, find the center and drive an old boiler tube, first flattening the lower end, until the end is nearly flush with the ground and fit a plug in the end of tube and mark the center with a tack. Dig a hole around the boiler tube and having straightened up the tube so that the back comes at the intersection of the cords, place a section of terra-cotta pipe with the flange down as far below the surface as desired, then fill around the tube with cement. Drive the plug down in tube, fill end with cement and place a copper nail in center. This forms a mark that no one can remove without considerable work. Suitable reference marks should be established also, for while the iron tube will last for many years it will in time go, and it may be necessary to dig for the sub-surface mark. If no terra-cotta pipe be available, place a box 6 inches square and two feet long around the

tube and fill in with cement. If the top of the terra-cotta pipe be left above the ground the earth should be heaped over it and a pile of stones placed over the mound if they are found to be near.

Sub-surface marks, unless they have pipes driven close to them, are hard to find unless the reference marks are piles of stones, as stakes rot in a few years. When no pipes are available to use with the cement mark, it should be made so long and heavy that it cannot be readily disturbed. While the cement is soft, place a copper nail in it to mark the center.

A signal record book should be kept in which the officer or surveyor in charge of the triangulation should be required to make an entry over his signature describing all center and reference marks for each signal built, with sketches showing the locations and giving angles and true bearings to prominent objects.

Buoy for floating signals.

In Fig. 8, at A and B are shown views of a buoy for floating signals which will be found more convenient to handle than the raft shown in Fig. 4. If made of the dimensions given in Fig. 8, 3 feet in diameter and 2 feet high, it will support about 600 pounds dead weight. A similar buoy 3 feet in diameter, 2½ feet high, will support about 800 pounds dead weight. These buoys should be made of galvanized iron or steel about 3/16-inch thick or 7/16 pound plate.

a,b,c, Pad-eyes to which slings for handling buoy are made fast.

d, Pad-eye for mooring chain or pendant.

e, Ring for slings.

f, Pipe at least 4 inches in diameter for mast. This mast should be in two sections, the upper section with the beacon head is bolted to the lower which passes through f, and has about 200 pounds or more of ballast on its lower end and extends 15 or 20 feet below the water.

M, Man-hole.

The mast for this buoy had best be made of two sections of galvanized iron pipe, the lower section of the proper size to pass through f, with a collar or flange around its upper end to prevent its slipping through f. The upper section slides into the lower when the buoy is not in use. When the buoy is in use the upper section is kept in position by a through bolt above the flange. A cast iron ballast ball weighing about 200 pounds, with a short section of 4-inch pipe cast into it should be attached to the lower

end of the lower section by a through bolt. The ballast balls will be found much more convenient than the improvised ballast made of old grate bars. The diameter of cast iron sphere weighing 200 pounds is about 11.3 inches.

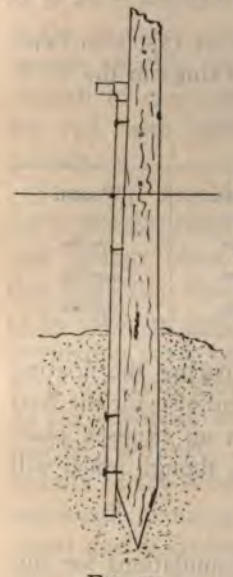
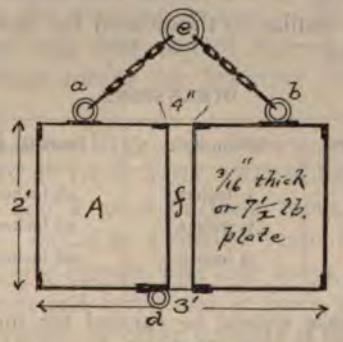


FIG. 11.

FIG. 8.



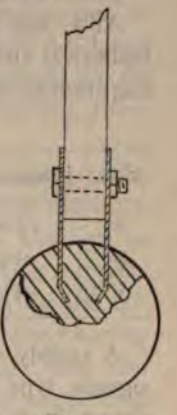
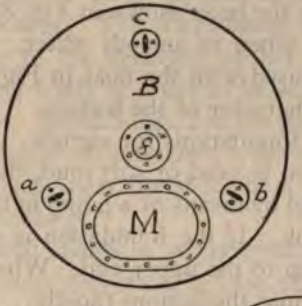


FIG. 10.



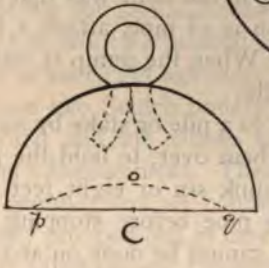


FIG. 9.

A sketch of a ballast ball is shown in Fig. 10. While the lower section of the mast should always be made of a pipe, the upper section may often be conveniently made of wood.

Boat chain made of iron ⅜-inch in diameter should be heavy enough for any of the signals described herein, and the chains should be galvanized. When the water is deep, wire rope,

on account of being lighter, should be used. Before having the rafts or buoys made, figure out from the approximate depth of water the weight of chain or wire pendant that will be needed and increase the size of the buoys if necessary.

Sinkers for floating signals.

At C and D, Fig. 9, are shown two views of cast iron hemispherical sinkers similar to those used for moorings in the U. S. Lighthouse Service.

DIMENSIONS.

Type.	Radius of Sphere.	Distance Co.	Distance pq.	Weight.
A	11⅞ inches.	3 inches.	20½ inches.	770 lbs.
B	13½ inches.	3 inches.	23½ inches.	1200 lbs.
C	15½ inches.	3½ inches.	26¼ inches.	1850 lbs.

A supply of these should be carried for mooring the floating signals, type A for the buoy shown in Fig. 8, and also for the float shown in Fig. 4, when in smooth water. In an exposed place type B should be used with the float in Fig. 4, though much will depend upon the character of the bottom.

Pumping down foundations for signals.

When the bottom is sand or soft mud, the foundations for signals may be planted by means of a pump in the same way that concrete piles are sunk. If the foundation is of pipe, attach a hose from a steam pump to the upper end. When the pump is started the pipe will sink into the bottom rapidly.

In the same way, by attaching a pipe to a pile or stake by means of wire spikes driven alongside it and bent over, to hold the pipe securely but loosely, the pile may be sunk six or eight feet into the bottom with ease. Withdraw the pipe before stopping the pump, otherwise if working in sand, it cannot be done on account of the sand settling around and filling up the pipe. (See Fig. 11). Keep the ship or tender in position by kedges off either quarter if necessary. I am informed by Commander J. H. Hetherington, U. S. Navy, that he has planted piles 12 inches in diameter in this way.

General remarks on the proper outfit for an efficient surveying expedition.

In the past, as a rule, surveying ships have been too small to be economical and efficient. A ship for this service should be large

enough to carry an ample supply of coal and provisions, lumber, old canvas, old piping and boiler tubes, and other material which may be picked up at a navy yard without cost, and which would be expensive to obtain on the working ground, either in money or at an expenditure of time and labor, as well as enough regular stores to make the ship self-sustaining, and thus enable her to remain steadily on the working ground. She should be large enough to carry at least four 40-foot steamers on deck, or on the rail, with suitable means for lowering and hoisting them quickly.

The ship should have large and efficient evaporators, tanks for a reserve supply of fresh water, electric lights, ice machine, cold storage plant and a good drafting room. In addition to this large ship there should be a smaller vessel to act as a tender to be used for building signals, planting buoys, carrying the triangulation party back and forth, and at times go to neighboring ports for fresh provisions or other supplies if necessary, and also do the off-shore soundings. The movements of the larger ship will be restricted, due to the necessity of her remaining in the vicinity of the sounding boats in order to be accessible in case of bad weather coming on. Besides this, and the danger to the larger vessel due to cruising about in unknown waters, she cannot ordinarily approach sufficiently near the shore or to shoals to be used efficiently for signal building.

While working around shoals in unsurveyed waters the tender must at times get aground, therefore, in case she does not happen to have two Scotch boilers, she should be fitted with water tanks forward and aft whose capacity is at least 4 per cent of the vessel's displacement. These should be kept full when on the working ground, and so connected to the pumps that they may be quickly pumped out in case of grounding. Cloud shadows on the water often present the appearance of shoals, and are so deceptive that they will worry one considerably at first, and when the sun is ahead or right overhead, it is almost impossible to distinguish a shoal by eye; the lead is the only thing to depend upon, but with the greatest care, when working among reefs, or when the water shoals suddenly, the tender is at times liable to get aground, hence the great utility of the water ballast. If in a territory where you suspect rocks keep a boat ahead of the tender unless working in a protected place.

SAMUEL·PIERPONT·LANGLEY
MDCCCXXXIV — MCMVI
SECRETARY OF THE SMITHSONIAN INSTITUTION
MDCCCLXXVI — MCMVI
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OF SURFACES MOVING IN AIR
HAVE BROUGHT TO A CLOSE THE PORTION OF THE WORK WHICH SEEMED TO BE ASSIG-
NED TO ME: THE DEMONSTRATION OF THE PRACTICABILITY OF MECHANICAL FLIGHT
THE GREAT UNIVERSAL HIGHWAY OVER WHICH IS NOW SOON TO BE OPENED

The Langley Memorial.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AVIATION TO-DAY,* AND THE NECESSITY FOR A NATIONAL AERODYNAMIC LABORATORY.

By Captain W. Irving Chambers, U. S. Navy.

The status of aviation in the world to-day may be summarized as follows:

The work of established aerodynamic laboratories has transported aeronautics generally into the domain of engineering, in consequence of which aviation has reached a stage of development wherein the methods of scientific engineers have replaced the crude efforts of the pioneer inventors.

The development of aviation for marine or naval purposes has naturally been somewhat delayed, but, inspired by the early demonstrations of our navy, the naval powers of the world are now devoting large sums of money to this phase of development. It may be asserted that although the aeroplane has not yet arrived at the state of perfection required by all the work contemplated for it in naval warfare, yet it is sufficiently advanced to be of great service in many ways, should it be required for use in emergency, and its satisfactory development for extensive use is fairly in sight.

Those who are engaged in the development of aviation for war purposes do not pretend that it is going to revolutionize warefare, but it has been fully demonstrated that of two opposing forces, the one which possesses superiority in aerial equipment and skill will surely hold a very great advantage.

Contemplated Uses of Aeroplanes in Naval Warfare.

A. They can be carried, stowed, and used by all large ships.

(1) To reconnoiter an enemy's port, or to search out his advanced bases and to assist in the operations of a blockaded or a blockading force.

* November 12, 1912.

(2) To locate and destroy submarine mines, submarines and dirigibles, and to assist in the operations of submarines and torpedo boats.

(3) To damage an enemy's docks, magazines, ships in repair or under construction, dirigible sheds and other resources.

(4) To provide means of rapid confidential communication between a fleet commander and the commanding officer of a co-operating force on shore, or of the commander of another fleet or division.

B. They can be carried by all scouts and large cruisers.

(5) To extend the "eyes of the fleet" in naval scouting.

C. They can be carried, with ample supplies and camp outfit, on board any naval supply auxiliary,

(6) For scouting at advanced bases and for extensive use with expeditionary forces.

WHAT IS BEING DONE ELSEWHERE.

France leads the world in aviation and all that she does is worth noting. A short time ago, in response to an inquiry by the Minister of War, over 3000 officers signified their desire to learn aerial navigation. Germany leads in aerostation, but is making great progress in aviation also. France has eight dirigibles, Germany thirty. The number of aeroplanes actually possessed by each is a rapidly increasing quantity, but France will probably possess about 350 before the end of the year, the ultimate aim being to possess 1000 as soon as the requisite number of pilots can be taught to use them.

The following statement, while it does not include all large sums that are being spent, will suffice to compare our own activity with that of some of the principal powers:

	Government appropriation	Popular subscription	Total
France	$6,400,000	$1,000,000	$7,400,000
Germany	1,500,000	750,000	2,250,000
Russia	5,000,000	(?)	5,000,000
Great Britain	2,100,000	(?)	2,100,000
Italy	2,000,000	100,000	2,100,000
Japan	600,000	(?)	600,000
United States	140,000	....	140,000

As Italy is the first to have had extensive experience with aircraft in actual war so far, some observations on her establishment and her experience will be of special interest.

In 1911 there were no public or private aeroplane factories of any importance in Italy, but this year the Aeronautic League has been formed, privately, to present to the government as many aeroplanes as possible. Funds have thus been raised to donate 100 aeroplanes, and now there are about 10 factories expecting to profit by this popular interest in the military use of aeroplanes.

There are now four squads of aviators serving in Tripoli and Cyrenaica, with 40 aeroplanes, mostly of French make, and there are 30 more in Italy.

These aeroplanes have been effectively used in scouting and they were the first to practice bomb throwing. Bomb throwing from Italian aeroplanes has been abandoned in Tripoli, however, because of its inaccuracy, and the inability to carry a sufficient number of the size required, and the attendant risk to the aviator. The Italian aviators prefer to fly without passengers. It is probable that the Italian machines, being hastily purchased, were not weight carriers, and did not have much range between high and low speeds,

For bomb dropping the dirigibles have proved greatly superior.

The captains of all dirigibles are naval officers, and the semi-rigid type is now preferred.

Under the existing conditions in Tripoli, and with no enemy in the air, and hangars available on shore, the net results have been all in favor of dirigibles for observation purposes, for taking photographs and for dropping bombs.

Bombs have dropped with good effect over Turkish camps, and good bombs have been supplied which can be timed to burst in air, as well as others which are incendiary. An apparatus has been devised by which bombs can be thrown horizontally as well as with a certain angle of inclination.

Weather conditions being equal, the Italian dirigibles, which, owing to their reversible propellers, are able to remain stationary in air, can furnish more reliable reports than aeroplanes.

The aeroplane as used at Tripoli cannot fly at night when the best weather conditions obtain; the dirigible prefers to do so, as it then loses no gas.

Aeroplanes are found to be quite safe from musketry fire at

3000 feet height. They have been hit on several occasions at lower altitudes, but without serious damage resulting.

The best aeroplane flights have been from Tripoli to Gharian and back, about 90 miles each way, and to Homs and back, 70 miles each way. The aeroplanes used can easily reconnoiter at 100 km. (62¼ miles) per hour.

The best dirigible flight was from Tripoli to Sidi Sidi and back, a distance of about 125 km. (77.6 miles), during which two of the small type left Tripoli in the early morning and explored all the coast, including the Turko-Arab positions at Zuara, where they dropped bombs effectively, the whole time being 9 hours 55 minutes. Off Zuara they replenished their fuel tanks from the boats of the fleet at sea.

LATE NOTE.—The latest German dirigible recently made a flight of 1200 miles, but it is much larger than those used by the Italians.

On one occasion one of the dirigibles was struck a number of times in the after part by rifle bullets (volley fire), and returned to the hangar down by the stern.

Messages have been dropped from dirigibles in small sand bags with parachutes to which colored pennants were attached, and communication by flag or semaphore has been used, but wireless has not been used on account of the danger and incomplete development.

The Italian doctors claim that aeroplane pilots, of the machines used in Tripoli, will last effectually but six months, after which they require two years of rest, but that the dirigible pilots last indefinitely.

This result will be modified by the introduction of automatic control, mentioned later.

FOREIGN NAVAL AVIATION.

Italy.—Last year 15 naval officers were detailed for aeronautical service, at which time six Farman, three Bleriot, one Nieuport and one Etrich machine were available.

Two hydroaeroplanes, original designs by Italian naval officers, have been building for some time at the naval dock yard, Spezzia, and at Bracciano, the chief aeronautic station.

France.—In February of this year, a foreign periodical, referring to the purchase of a Curtiss hydroaeroplane by Paulhan, the French aviator, made the following statement:

It is probable that the American Curtiss hydroaeroplane will soon find its way in large quantities into the French Navy, which at present owns officially one aeroplane only, an old pattern Maurice Farman.

I am not sure that this was authentic, but I have noted in the French press frequent expression of regret that they had allowed the Americans to precede them in the naval development of aviation However, since then they have made up for lost time by providing a systematic organization, and the appropriation of ample funds for naval aviation. Their establishment includes a naval aviation center on the coast of Frejus, about half way between Toulon nd Nice.

The cruiser *Foudre,* formerly used as a mine ship, has been fitted out as an aviation ship, located at Frejus. The first hydroaeroplane accepted, a Voisin, has been hoisted in and out in three minutes. The *Foudre* does not permit of housing machines in sufficient numbers, and hangars are erected on shore to accomodate other machines that have been acquired.

During the recent maneuvers of the French fleet in the Gulf of Juan, near Frejus, where one squadron was blockaded by another, the commanding officer of the *Foudre* visited the flagship of the blockaded forces in a torpedo destroyer, and informed the admiral that one of his aeroplanes, during a reconnaisance of the Gulf, had obtained exact information concerning the disposition and movements of the blockading squadrons. Submarines had been observed navigating on the surface with evident intention of attacking the blockading force. At no time had the blockading squadron, located 15 miles off shore, perceived or heard the aeroplanes. One Nieuport (100 h. p.), three place, monoplane, one Farman and one Voisin biplane were used.

England.—Last year public indignation was aroused in England because a few naval officers had been obliged to learn the art of flying entirely on their own responsibility, and at their own expense, and because the first naval aeroplanes, two Valkyrie machines have been privately donated by a public spirited citizen.

On January 11, 1912, Acting Commander C. R. Samson, R. N., made the first flight from an English battleship over a rail platform erected over the bows of H. B. M. S. *Africa,* in much the same manner as Eugene Ely flew from the U. S. S. *Birmingham,* and the U. S. S. *Pennsylvania* in 1910.

An official reply to a query in Parliament, noted March 6, 1912, concerning England's preparedness in naval aviation, follows:

> One hydroaeroplane is now under construction at Eastchurch and two others are on order. Experiments with this type are being continued at Sheerness, Lake Windemere and Barrow.

The Royal Flying Corps has been established, and the naval wing of this corps has its headquarters at the Naval Flying School at Eastchurch. The memorandum to Parliament states:

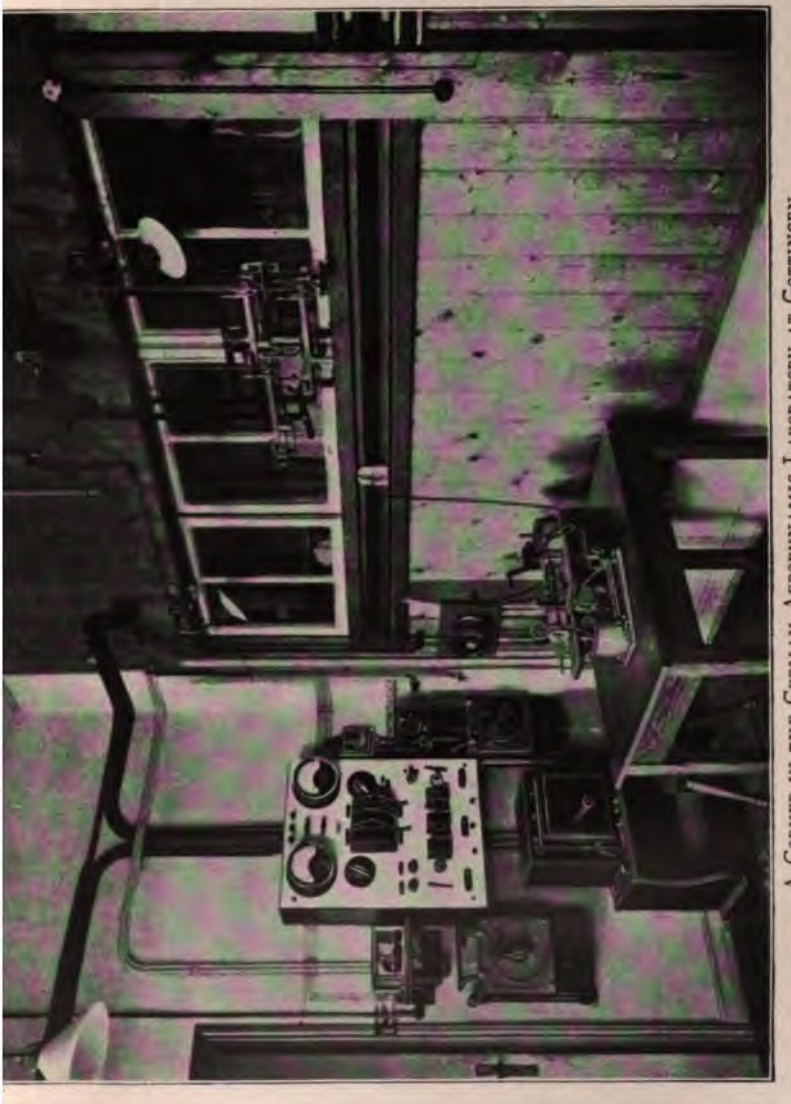
> It is impossible to forecast what its ultimate organization will be, as this depends to a great extent upon the results of experiments which are about to be commenced with hydroaeroplanes. The present organization must, therefore, be regarded as provisional.

Germany.—It is significant of German foresight that one of the first steps undertaken, when it was decided to construct a large aeroplane fleet, was to found an aerodynamic laboratory. This is at Gottingen, where the best known course of instruction in aeronautics is ably conducted by Professor Prandtl.

The Berlin Aero Exposition of this year showed a surprising development in domestic aeroplane progress. There were 176 exhibitors. Twenty-two aeroplane firms were represented by 40 aeroplanes of which not more than three were freaks, and three showed defective construction. There were 18 motor firms represented by 41 different types of motors, 41 firms for accessories, 5 tool firms and 6 steel firms.

Several German naval officers have perfected themselves in aviation, and several types of machines have been used for naval work, of both foreign and domestic make. Our Curtiss hydroaeroplane has been procured.

A competitive test for hydroaeroplanes, arranged jointly by the German Flying League, and the Imperial Navy Office, took place at Heiligendamm, from August 29 to September 5. Competitors were required to be German subjects, and every part of the machines competing, except the motor, was made in Germany. Competitors were required, after ascent from a given spot on land, to remain in the air for one hour, to alight on the water within a square of 150 meter sides, marked by buoys, to stop the motor and, after resting on the water for not more than 20 minutes, reascend to a height of 500 meters and return to the starting place entirely unassisted.



A Corner in the German Aerodynamic Laboratory at Gottingen.

It is astonishing to learn how nearly the characteristics required of the machines in this competition correspond to our own "requirements," independently conceived.

These machines must have sufficient inherent stability to resist sudden squalls and must be so readily guided that the pilot will not be exhausted by the longest flight.

When the motor stops in air the machine must commence to glide automatically.

The gas throttle and all levers for regulation of motor must be large and substantial and situated on the right of the pilot's seat, about 20 inches in advance of the back of the seat.

Seats arranged for two persons must be arranged so that clear view forward, each side and downward is provided for both occupants and the latter must be protected from the draft of air. Elastic leather belts 3 inches wide must be attached to each seat and arranged to be cast adrift quickly by either the right or the left hand.

It must be possible to control from both seats and the pilot must be able to cut off the control from the passenger seat.

The motor and the pilot seats must be protected against the splashing water.

The propeller must be protected against coming in contact with water by a special arrangement. Preventative measures against short circuit, in consequence of the moisture, must be provided and the machine must have a speed of at least 80 km. (49.7 miles) per hour.

LATE NOTE.—There were seven entries in this contest, only one of which succeeded entirely.

Other Countries.—Exact details are lacking of the progress in many other countries, but all progressive powers are bent on keeping abreast of the times, especially the British Colonies, Russia, Japan and Austria. The latter country has produced one of the very best aeroplanes in existence, the Etrich, and is also developing the hydroaeroplane.

DEVELOPMENT IN THE UNITED STATES NAVY.

When Congress appropriated $25,000 for the development of naval aviation last year, three officers had been ordered to aeroplane factories for instruction, in anticipation of three machines which were finally purchased, two Curtiss and one Wright.

At that time a land aerodrome was necessary for practice, and a hangar was accordingly built on Greenbury Point, Annapolis, Md., where a sufficient area of flat land was prepared for an aerodrome by the leveling of some trees and the partial filling of a swamp. This served its purpose until the navy machines had all

been provided with hydroplanes, and we had demonstrated the practicability of carrying on instruction entirely over water. The

THE HANGARS AT GREENBURY POINT, ANNAPOLIS.

THE NAVY WRIGHT MACHINE AT ANNAPOLIS.

aerodrome is now held in reserve for the housing of spare machines, for the exercise of the land attachment of the hydro-aeroplanes and for any other emergency use.

It was originally contemplated to establish an aviation school in conjunction with the Naval Engineering Experiment Station,

THE NAVY CURTISS LEAVING FOR A FLIGHT IN CHESAPEAKE BAY.

NAVAL AVIATION CAMP AT ANNAPOLIS. GREENBURY POINT IN THE DISTANCE.
(Taken from an aeroplane.)

where experiments could be expedited, but it soon became apparent that the desired number of officers and men could not be

spared away from their regular duties for a sufficient period, and that the progress of instruction would be seriously delayed until the machines had been suitably developed and equipped for issuing to ships of the fleet, where practical instruction could proceed, with ample resources, in a systematic routine way. Incidentally, it was recognized that to get good service from these machines in the fleet, constant practice would be required, and the personnel be made as familiar with them as with other articles of equipment.

This was the first object in favoring the hydroaeroplane attachment.

To-day it is recognized the world over that hydroaviation offers one of the most promising fields of development, for the reason that a water aerodrome is nearly always available, is safer in landing, is less obstructed, and the aerial currents over water are less treacherous than over land. A ship provided with aeroplanes will thus become the hangar and will be surrounded usually by an ideal aerodrome, *i. e.*, by water sufficiently smooth for practice.

Last December the three machines, with their aviators, were transferred to San Diego, Cal., where a camp was formed with small tents from the U. S. S. *Iris*, and hangar tents, of the army pattern, which had been prepared at the Mare Island Navy Yard.

Experience with these tents demonstrated certain defects, and that they were not conducive to efficient progress with a small force of men. Better tents, designed by the Bureau of Construction and Repair, have been made to replace them.

After a season of winter work at San Diego, the camp was transferred again to Annapolis, and located nearer the Engineering Experiment Station, on the north shore of the Severn River. This experience with tents has demonstrated that they not only facilitate the removal of a camp from one place to another, but that it is cheaper to use them than to provide permanent sheds of more durable material at all places where a camp may be established. The use of tents also enables us to be prepared, with the advantage of experience, to transport, at short notice, all the material that may be required at an advanced base.

INSTRUCTIONS AND TESTS.

Many officers, interested in this work, have applied for instruction, but, as before mentioned, it has not been possible to detach from their regular duties, even temporarily, all who desire the experience. Eight officers have qualified.

At the end of August, 1912, a total of 593 flights had been made by the four instruction aviators in the three machines. The record stands as follows:

IN CURTISS MACHINES.

	Flights	Total time	Distance	Passengers carried
		Hrs. Min.	*Miles*	
Lieutenant Ellyson	200	40 30	2227	111
Lieutenant Towers	202	37 2	2035	100

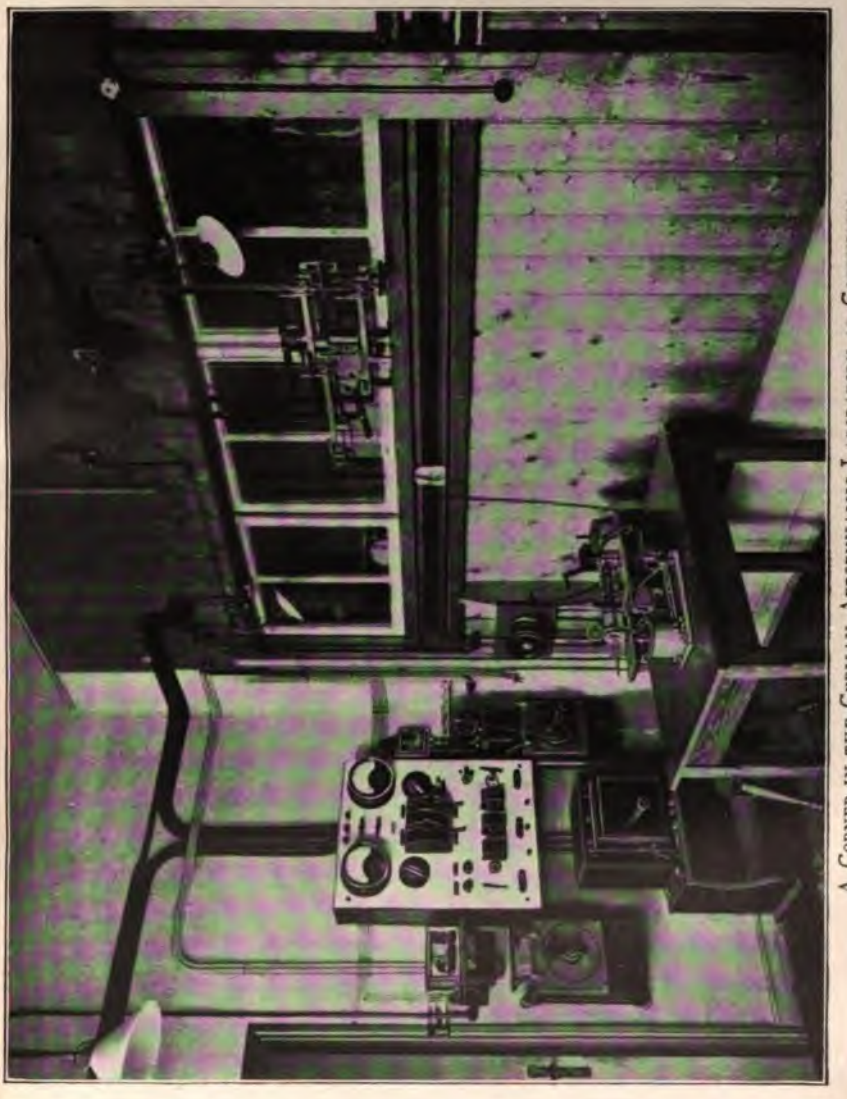
IN THE WRIGHT MACHINE.

Lieutenant Rodgers	132	33 54	1530	52
Ensign Herbster	59	14 54	630	1
Total	593	126 20	6422	27

During flights over water the aviator can usually count on a safe place to land. For this reason most of our hydro-flying has been done at an altitude of about 500 feet. But, as scouting and reconnaisance work will require flying at an altitude of about 3000 feet, Lieutenant Ellyson has demonstrated that there will be no difficulty in flying the hydroaeroplane at 3000 feet or over. On one occasion he ascended to 2850 feet in 23 minutes and 45 seconds. On another occasion, in testing a lower grade of gasoline, he ascended 3200 feet, but it required 44 minutes to reach the first 2500 feet. Investigation of the different grades of gasoline shows that the difference in efficiency is considerable.

The longest flight yet made with passenger anywhere, in the hydroaeroplane, is that made by Lieutenants Ellyson and Towers jointly, from Annapolis, Md., to Hampton Roads, Va., and return, and this flight amply demonstrated three things: (1) the suitability of the "hydro" as a type for long flights; (2) the practicability and utility of the dual system of control, and (3) the necessity for greater improvement in motors. The return flight was enlivened, in very cold weather, by a series of minor mishaps to the motor. In making such flights it is still advisable to follow a shore line convenient for landing in case of motor trouble.

Lieutenant J. H. Towers, U. S. Navy, has recently made a flight of 6 hours, 10 minutes and 20 seconds, with the standard navy Curtiss hydroaeroplane. This was made in due course of a regu-



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spared away from their regular duties for a sufficient period, and that the progress of instruction would be seriously delayed until the machines had been suitably developed and equipped for issuing to ships of the fleet, where practical instruction could proceed, with ample resources, in a systematic routine way. Incidentally, it was recognized that to get good service from these machines in the fleet, constant practice would be required, and the personnel be made as familiar with them as with other articles of equipment.

This was the first object in favoring the hydroaeroplane attachment.

To-day it is recognized the world over that hydroaviation offers one of the most promising fields of development, for the reason that a water aerodrome is nearly always available, is safer in landing, is less obstructed, and the aerial currents over water are less treacherous than over land. A ship provided with aeroplanes will thus become the hangar and will be surrounded usually by an ideal aerodrome, *i. e.*, by water sufficiently smooth for practice.

Last December the three machines, with their aviators, were transferred to San Diego, Cal., where a camp was formed with small tents from the U. S. S. *Iris*, and hangar tents, of the army pattern, which had been prepared at the Mare Island Navy Yard.

Experience with these tents demonstrated certain defects, and that they were not conducive to efficient progress with a small force of men. Better tents, designed by the Bureau of Construction and Repair, have been made to replace them.

After a season of winter work at San Diego, the camp was transferred again to Annapolis, and located nearer the Engineering Experiment Station, on the north shore of the Severn River. This experience with tents has demonstrated that they not only facilitate the removal of a camp from one place to another, but that it is cheaper to use them than to provide permanent sheds of more durable material at all places where a camp may be established. The use of tents also enables us to be prepared, with the advantage of experience, to transport, at short notice, all the material that may be required at an advanced base.

INSTRUCTIONS AND TESTS.

Many officers, interested in this work, have applied for instruction, but, as before mentioned, it has not been possible to detach from their regular duties, even temporarily, all who desire the experience. Eight officers have qualified.

At the end of August, 1912, a total of 593 flights had been made by the four instruction aviators in the three machines. The record stands as follows:

IN CURTISS MACHINES.

	Flights	Total time	Distance	Passengers carried
		Hrs. Min.	*Miles*	
Lieutenant Ellyson	200	40 30	2227	111
Lieutenant Towers	202	37 2	2035	100

IN THE WRIGHT MACHINE.

Lieutenant Rodgers	132	33 54	1530	52
Ensign Herbster	59	14 54	630	1
Total	593	126 20	6422	3

During flights over water the aviator can usually count on a safe place to land. For this reason most of our hydro-flying has been done at an altitude of about 500 feet. But, as scouting and reconnaisance work will require flying at an altitude of about 3000 feet, Lieutenant Ellyson has demonstrated that there will be no difficulty in flying the hydroaeroplane at 3000 feet or over. On one occasion he ascended to 2850 feet in 23 minutes and 25 seconds. On another occasion, in testing a lower grade of gasoline, he ascended 3200 feet, but it required 44 minutes to reach the first 2500 feet. Investigation of the different grades of gasoline shows that the difference in efficiency is considerable.

The longest flight yet made with passenger anywhere, in the hydroaeroplane, is that made by Lieutenants Ellyson and Towers jointly, from Annapolis, Md., to Hampton Roads, Va., and return, and this flight amply demonstrated three things: (1) the suitability of the "hydro" as a type for long flights; (2) the practicability and utility of the dual system of control, and (3) the necessity for greater improvement in motors. The return flight was enlivened, in very cold weather, by a series of minor mishaps to the motor. In making such flights it is still advisable to follow a shore line convenient for landing in case of motor trouble.

Lieutenant J. H. Towers, U. S. Navy, has recently made a flight of 6 hours, 10 minutes and 20 seconds, with the standard navy Curtiss hydroaeroplane. This was made in due course of a regu-

lar work, but it stands as a world's record for flight in a hydro-aeroplane. A performance of five hours only would have been satisfactory.

As a part of the instruction and a fruitful means of informing us concerning necessary improvements, many repairs have been made by the aviators themselves, and the enlisted mechanics detailed for the purpose have received instruction in this way. A new Wright machine has also been built in this way from spare parts purchased from the company.

It has not been possible, under the circumstances of a meagre appropriation and few officers, combining instruction with experimental work, to establish a thoroughly satisfactory system of instruction as yet. The ideal would require each aviator student to obtain a course of study in aerodynamics and meteorology up to date, of about four months, such as that recently established at the Massachusetts Institute of Technology, the theory preceding the practical work, if possible. Such a course would be best attained by the establishment of a school for aviators in connection with the lectures at a national aerodynamic laboratory.

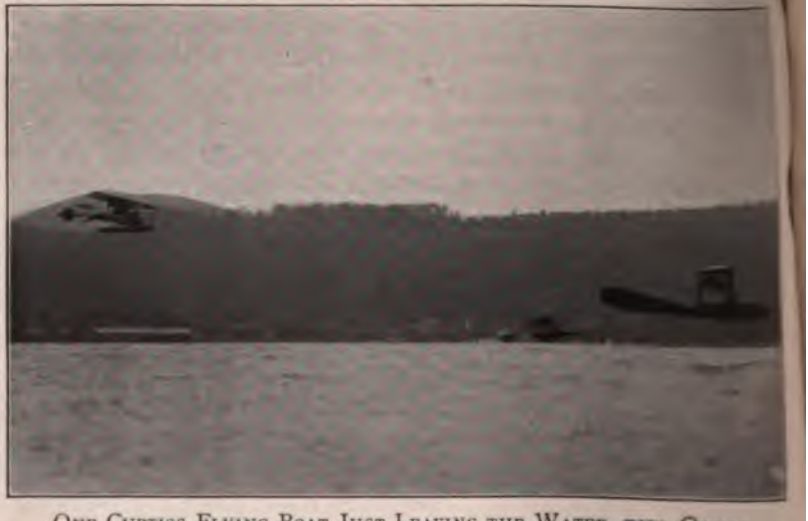
Experimental work.—The work of instruction has been handicapped by a practically continuous series of experiments, with the result that long delays in repairing have rendered work in both particulars slower than was anticipated. On the whole, this method of experimentation for the solution of problems other than the improvement of minor structural details and the test of navigating instruments is very unsatisfactory. Important experiments involving physical research should be relegated to an aerodynamic laboratory and its aerodrome annex. Other important experiments, such as the development of wireless, requiring frequent changes, should be made at an aircraft factory where extensive repairs and reconstruction are facilitated. Special facilities already exist for doing such work at the Washington navy yard.

Some experimental work has been done on different methods of installing the wireless plant, but intermittently, owing to the enforced absence of the expert officer whose suggestions were being followed. Although the work is unfinished, it has given promise of realizing a range of 50 miles at a sacrifice of 50 pounds only in weight.

Most of the experiments have been devoted to improving mechanical details of the motors and to trying different models of

hydroplanes, the result of laboratory investigation at the Model Basin.

TWO CURTISS FLYING BOATS AND A HYDROAEROPLANE.
One boat going across the wind the other against it.



ONE CURTISS FLYING BOAT JUST LEAVING THE WATER, THE OTHER DESCENDING. THE HYDROAEROPLANE FOLLOWING.

Much useful information has been gained thus about hydroplanes, and many uncertain but alluring ideas have been eliminated.

There are seven different types of hydroaeroplanes now in France, but our efforts have been confined chiefly to two distinct American types, the single boat with balancing pontoons, and the catamaran type with two pontoons. Both types have given great satisfaction, but the single boat, which has been used on both the Wright and the Curtiss machines, seems best for our purposes. It is superior in rough water, and it is the father of the flying boat, towards which our ideas have always been inclined.

THE CURTISS FLYING BOAT.

The *Flying Boat* was discussed in the early days, about 1905, between Mr. Glenn H. Curtiss, and representatives of the Bureau of Equipment. The first real flying boat was made and tested at Hammondsport, N. Y., a year ago last summer, and flown last winter at San Diego, Cal. After several alterations in the location of the motive power, the Curtiss flying boat tested this summer, with great satisfaction, by Lieutenants Ellyson and Towers, is regarded as a decided advance in hydroaeroplane design, and gives promise of extended usefulness in rough water.

The practicability of sending aeroplanes in flight from a suitable platform on board ship was early demonstrated by Eugene Ely in flights from the U. S. S. *Birmingham* and the U. S. S. *Pennsylvania*. We have frequently demonstrated the practica-

bility of sending them in flight from water alongside of a ship, and both Mr. Glenn H. Curtiss and Lieutenant John Rodgers have flown alongside of a ship, have been hoisted on board and hoisted out again in a hydroaeroplane. Lieutenant Ellyson has successfully performed the daring experiment of showing the possibility and facility with which a hydroaeroplane can be sent in flight from a ship in smooth water over an improvised single wire cable, but I would not recommend the use of this device on a ship with rolling motion. Lieutenant Ellyson eagerly subjected himself in a

LIEUTENANT ELLYSON LEAVING A WIRE CABLE IN FLIGHT.

hydroaeroplane to the extreme shock of the first catapult device in order test the effect of such a shock, not only on the aviator but on the motor attachments and other fittings. This crucial test was entirely satisfactory in its revelations, although the aviator and the machine got a ducking, and it will probably never be required again.

There is no risk that these zealous aviators will not cheerfully undertake in the interest of adapting the art of aviation to naval purposes, and it is worthy of note that the work has progressed thus far without serious accident, although it has been ardous, dangerous and replete with temptations for the aviators to rival many of the sensational performances that have resulted disastrously to contemporary pioneers in civil aviation.

A simple and convenient self-starter is a practical necessity to the hydroaeroplane before issuing it for ship use. Several mechanical devices have been tried with varying success, but other more promising devices are about to be tried, and there is reason to believe that the very best will soon be in use on all of our machines.

The *navy aeroplane catapult* is a simple device for getting aeroplanes away from a ship in the quickest manner, and over the shortest track, the object being to avoid carrying on board ship any more paraphernalia than necessary to accomplish the object.

It has been demonstrated several times that an aeroplane can leave a ship by its own power over a suitable platform that is long enough, and can even alight on such a platform, under favorable circumstances, but it is desired to avoid the encumbrance of a platform.

The catapult is so small that it occupies little space, it can even be mounted for use on top of a turret, it can be transported to any location on the ship, and it can be readily dismounted and stowed away clear of the guns.

Compressed air is used for the power, as all ships carrying torpedoes are supplied with air compressors. When preparing the apparatus for use the air is pumped, to a suitable pressure, into a receiver which is connected with a small cylinder conveniently located on deck. The piston of the cylinder has a stroke of about 40 inches, and the piston rod is connected with a small wooden car by means of a wire rope purchase which multiplies the travel of the piston to any desired extent, or to any limit fixed by the travel of the car on its tracks.

The aeroplane, of course, rests upon the car and, when a flight takes place, both are projected from the tracks together in about 1½ seconds, the pressure being automatically and gradually accelerated throughout the stroke. The car drops into the water when free from the tracks, and is hauled on board by a rope attached to it.

The device, as used at the Washington navy yard, November 12, 1912, was mounted on a float (see Fig. 1), so that the bottom of the hydroplane was not more than two feet above the water. When discharged, the hydroaeroplane gradually arose in a steady, beautiful flight, as soon as it left the tracks, without any tendency to seek the water. (See Fig. 2, in which the car is seen just dropping clear of the hydroplane.)

During a previous trial, at Annapolis, the device was mounted rigidly on a wharf. The car and machine were both free to lift from the tracks during any part of the stroke, and after the aero-

FIG. 1.

plane motor had been started full speed, the full pressure of 200 pounds was turned on at once. On this occasion the machine reared at about midstroke and, as a cross wind was blowing, the

LIEUTENANT ELLYSON LEAVING THE CATAPULT.
FIG. 2.

right wing was thrown up, and a corkscrew dive into the water resulted. Lieutenant Ellyson, the aviator who managed the

machine on both occasions, and whose iron nerves were relied on to stand the shock, was fully satisfied, by this extreme test, that the shock ought not to deter any good aviator. It was also gratifying to note that no part of the machinery or fittings was ruptured or showed any signs of weakness.

When tried at the Washington navy yard, November 12, the float enabled the apparatus to be pointed towards the wind, which, however, was nearly calm at the time. The car was held down to the tracks by reverse flanges and extra wheels, and the balanced valve of the cylinder was arranged to be gradually opened to full power by a simple wedge shaped cam attached to the travelling block on the piston head. The aeroplane was also held down to the car by an iron strap, the ends of which were tripped automatically at the end of the stroke by studs on the tracks.[1]

[1] Mr. Glenn H. Curtiss, who witnessed the test, remarked that "this device is the most important achievement since wheels were put on land machines. It is now possible and practicable to have the large ships of the Navy equipped with aeroplanes. The catapult can be readily set up on top of a turret on board a battleship and will not be in the way. It can be turned in any direction, so that the aeroplane can be shot into the teeth of the wind.

"I have never seen anything prettier in my life than the getting away of Lieutenant Ellyson this afternoon. It was perfect and really undertaken under adverse conditions, for there was not a puff of air to assist the machine in rising.

"The simplicity of the catapult makes it valuable. It can be taken down and packed in a box eight feet square. On shipboard it would be very easy to furnish compressed air, and, although yesterday a small car was used, thoroughly greased rails would do just as well.

"I came here at the request of Captain Chambers to help, if possible. Captain Chambers has given the world something that will be eagerly taken up by every navy. Foreign navies will grab this idea, and probably the ships of Germany and Great Britain now building will have an aeroplane auxiliary.

"The hydroaeroplane is giving way to the aeroboat, or flying boat. The Navy has purchased one of this type, which will be delivered in Washington probably next week. It will be launched from the catapult. If this final test is successful there is no reason why the new *Pennsylvania* cannot be equipped with an aeroplane. The solution of safely launching an aeroplane from a battleship has been solved, so why not?

"I expect to see aeroplanes installed on battleships very soon now."

Captain Chambers believes that the success of the catapult opens great possibilities for the hydroaeroplane or the aeroboat, in the Navy. The catapult is light and can be taken down and stored in comparatively small space.

Almost two years ago, in Hampton Roads, Eugene B. Ely, since killed in

Several preliminary tests of the device, with sand bags to represent the weight of the aeroplane, were made before the final test of November 12, and curves of speed and pressure were obtained in each case. These curves are reassuring and demonstrate the possibility of getting, by this method, the curve of velocity to follow any trajectory desirable within practicable limits.

Figure 3 represents the car weighted with sandbags for a test at the Navy Yard, and Figure 4 shows the car with its sandbag burden just leaving the tracks. It is interesting to note in this

FIG. 3.

FIG. 4.

picture some of the heavy sand bags and the block to which the holding down strap was attached suspended in mid air, while the comparatively light car is dropping away from them.

This picture (Fig. 4), also shows the airflask, the cylinder, the piston rod and the cam.

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a machine, made the first flight from the deck of a vessel, rising in a biplane from the *Birmingham*. Compared with to-day's test, the method of two years ago was crude, a platform being used that occupied most of the deck space forward.

Instruments.—Aviators and manufacturers have been slow in making use of instruments which not only make flying safer, but which may be made to relieve the aviator of much of the nervous tension and strain of long flights and flying in uncertain weather. A constant increase in the number of disasters has disturbed the people of France for some time, with the result that special attention has been given to the problem of safety; special efforts have been made not only to improve inherent stability and structural strength, but to provide means for controlling the equilibrium automatically.

One cannot blame those who are already skilled in flying for being conservative in this matter, in view of the many defective devices that have been exploited to effect the object. There is a good reason for going slowly and carefully in the test of anything that presumes to take the place of the aviator's skill, but manufacturers and aviators are beginning to realize that progress in aviation is greatly dependent upon the perfection of instruments for safe guidance and automatic control, that there is something more than acrobatic skill required to place aviation on a practical footing in the navy, that the elimination of man as a factor of chief importance by the supply of mechanism which will perform the things that he is prone to do indifferently, especially under the strain of fatigue, is a practical necessity to his success as a real aerial navigator.

Simple and reliable automatic control devices which may be added without sacrifice of too much weight are now being eagerly sought, and some that may be rigged to work automatically, semi-automatically, or not at all, at the will of the aviator, are being made.

The Air Compass.—Much important work for which the aeroplane will be useful in the navy will not necessarily require the air pilot to navigate in a fog, or at night, or out of sight of his base, but in sea scouting, which I think is destined to be one of his principal spheres of usefulness, the pilot may be caught in a fog, he may be obliged to navigate at night and will have to lose sight of his base frequently. It must be possible, therefore, to navigate as accurately in air as it is to navigate a ship by dead reckoning at sea.

Motors.—Improvements have been confined principally to the correction of small defects, which have been made as soon as dis-

covered. Much more could be said about what is still needed. When anything goes wrong, or when trouble begins in a flight that promises well, some trifling detail of the motor is usually at fault, a small pin here, a pump connection there, but nearly always something new and unexpected. It was so with the early motors of automobiles, and this thought inspires confidence in the perfection of aviation motors, although the demand is still greater for increased power or speed rather than reliability and durability.

Range of Speed.—A weight carrying aeroplane such as a hydro-aeroplane necessarily needs a motor with considerable *range* of speed, and the same kind of motor is needed to reduce the danger of alighting. This is not the kind of motor and combination of motor and surfaces that now wins the speed contests such as that for the Gordon Bennett Cup. I think aviation would be improved if the terms of future speed contests were arranged so as to require each contestant to go over the course twice, the second time at an average speed 20 per cent lower than his highest average.

Requirements.—A year ago our manufacturers requested specific information as to the conditions to be satisfied in adapting the aeroplane for naval use. The answers at that time were necessarily indefinite, but with the benefit of a year's experience we have been able to issue a set of "general requirements," sufficiently broad in scope, to permit a wide latitude for ingenuity and improvement.

These requirements cover not not only the peculiar conditions to be satisfied in naval aviation, but, for the first time, require our builders to show that their machines are designed in accordance with up-to-date practice. Builders are required to prove technical data, which will eliminate from competition all who depend on haphazard methods. Complete stress diagrams under different conditions of load and all fundamental characteristics, a knowledge of which is indispensable to an intelligent comparison of designs, are demanded. The stamp of approval is given to the introduction of improved methods for the automatic control of equilibrium, and our builders are encouraged to attain a high degree of efficiency, to improve the factors which govern safety, and nothing is demanded that may not be readily accomplished under the limitations of the art as it is generally understood at present.

UNSATISFACTORY LIMITS IN APPROPRIATIONS.

In accordance with the policy of the Department, as mentioned in the last annual report of the Secretary of the Navy, aeroplanes are now placed in the same category as other articles of a ship's equipment, and are appropriated for accordingly, the general architecture and constructional features being provided by the Bureau of Construction and Repair under its general appropriation "construction and repair of vessels," and the motive power, including radio apparatus, being provided by the Bureau of Steam Engineering under the appropriation for "steam machinery," it being intended that all Bureaus will do their share in providing the specific parts which naturally come under their cognizance in the Department organization.

It seems unnecessary to place a limit on aeroplanes under these appropriations when expenditure on boats, steam steerers, windlasses, boilers and "all other auxiliaries" costing much more, is unlimited. No economy is effected by placing a limit on any one of the numerous items under these appropriations, and no extravagance can occur by removing the limits on aeroplanes because, regardless of limits, the amount of each appropriation remains the same, and expenditures on each item will be jealously guarded, by the Bureau concerned, to carry on current work as necessities arise.

It is particularly unfortunate that the small limit of $20,000 is placed on aeroplane machinery under the Bureau of Steam Engineering, because our experience shows that each aeroplane used for instruction requires two motors to carry on the work effectively. This, of course, will be impossible under the present limit, as the expense of repairs is also comparatively great. The limit of $35,000 under Construction and Repair is unsatisfactory also.

INFLUENCE OF FOREIGN LABORATORIES.

Little more than a year ago our knowledge of the effect of air currents upon aeroplane surfaces was almost entirely a matter of theory. The exact information available was so meager that aeroplanes were built either as copies, slightly modified, of other machines, or else by way of haphazard experiment. This state of affairs obtains to some extent in the United States to-day,

although in Europe aeroplane construction is now largely based on scientific data obtained at notable aerodynamic laboratories.

The intuitive, hasty and crude methods of the pioneer cannot succeed in competition with the accurate and systematic methods of the scientific engineer, and it is beginning to dawn upon our perceptions that, through lack of preparation for the work of the scientific engineer, *i. e.*, through delay in establishing an aerodynamic laboratory, a waste of time and money, a decline of prestige and an unnecessary sacrifice of human life has already resulted.

Students of aviation do not need to be informed of the practical necessity of aerodynamic laboratories. They have repeatedly

THE ST. CYR AERONAUTIC INSTITUTE.

pointed out, in aeronautical publications, the immense commercial advantages to be anticipated from the establishment of at least one in this country, and they have naturally expected that some philanthropic patriot, of wealth and scientific interest, would come to the rescue with a suitable endowment fund that would enable such work to be started in short order without government aid. The fact that no patriot has responded is disappointing, in view of the large private donations that have done so much for aviation in France, but in my opinion, it simply indicates something lacking in the manner of disseminating information concerning the importance of the subject. I am not willing to believe that our people will refuse to establish one when they are fully acquainted

with the advantages to humanity, and to sane industrial progress, and when a reasonable concrete proposition is advanced for their consideration. I have submitted such a proposition which follows, in general outline, the ideas advanced in an address to the Fifth International Aeronautic Congress by one of the greatest authorities in the world, the Commandant Paul Renard, President of the International Aeronautic Commission.

A NATIONAL AERODYNAMIC LABORATORY.

Before considering the character of the work to be done, and some details of the needed plant, it will facilitate matters to show what should *not* be done at such a laboratory.

There are those who dream of supplying the laboratory with all the instruments known to mechanics, to physics, and even to chemistry, in order to have a creditable and complete national institution. They would concentrate in one locality all the scientific instruments and acumen available with the false idea that economy would result. This would be a grave error.

The financial resources, however great, are sure to be limited, and a too ambitious or a superfluous installation would squander the sources of power and indirectly menace the initiative of other industries. The character of the new work to be done demands that everything should be rejected that can be dispensed with readily, in order that appliances specially needed in the new work may be provided, and that these appliances be of the latest and most efficient types.

For the sake of economy, not only of money but of time and intellectual energy, tests and experiments that can be executed as well or better elsewhere by existing establishments, should be avoided. For example, it is unnecessary to install a complete set of instruments and implements for testing the tensile strength of materials or their bending and crushing strength. Many other establishments permit of such work. If the laboratory be located in Washington, where certain advantages exist, such work could be readily done at the navy yard, where other facilities exist, such, for instance, as the testing of models for hydroaeroplanes, and flying boats. The Bureau of Standards and Measures, and other government branches in Washington, also offer facilities which it would not be wise to *duplicate* in such a laboratory.

I do not think that such an institution should be burdened with measuring the power of motors, or preoccupied with the details of their performances. This may be done at various other government establishments, and it is understood that the Automobile Club of America is also equipped for this work.

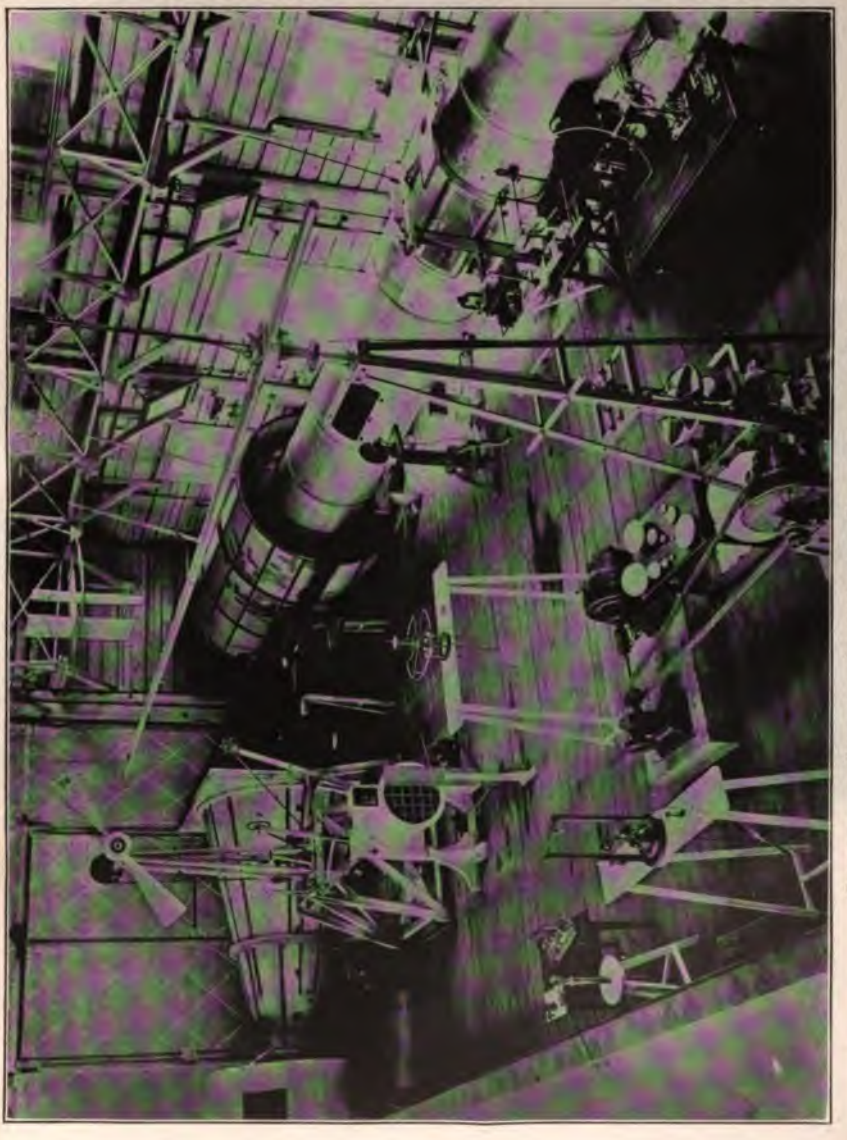
Nor is it necessary to have a complete chemical laboratory under the pretext of studying questions relating to the chemistry of fuel, or the permeability of balloon envelopes.

I do not wish to convey the idea that an aerodynamic laboratory should be deprived entirely of such facilities, and that it should be obliged to seek minor information from other establishments when that information may be more economically obtained by a duplicate plant on a small scale. Such duplicate conveniences, however, should be regarded as strictly accessory, *but* it should be well understood that, whenever important researches can be prosecuted as well or better elsewhere, dependence should be placed on those other establishments where such work is a specialty.

TWO DISTINCT CLASSES OF WORK.

An aerodynamic laboratory should be devoted to (1) experimental verification; (2) experimental research. The first is concerned with testing the qualities of existing appliances, propellers, sustaining surfaces, control mechanism, etc. Usually these tests are made at the request of interested parties (as is now the case with the water models at the navy yard model basin). A constructor or designer will bring, for example, a propeller, and will wish to know its power or thrust at a given speed on the block, or on a moving appliance under the conditions of flight, or he may bring several propellers to compare their performances and to ascertain what power they absorb at different speeds.

One of the very successful appliances devoted to this work at St. Cyr is a movable car in which an aeroplane may be mounted and tested at speeds, in perfect safety, as to its strength, its efficiency, and the suitability of its control mechanism. This device is specially adapted to make actual service tests of sustaining surfaces—in other words, to try out, in perfect safety, the relative efficiencies of finished aeroplanes. It is a most important adjunct, as it supplements and rounds out the important research work on models in the closed laboratory.



Interior of Russian Aerodynamic Laboratory at Koutchino.

Tests of this character, *i. e.*, verification tests, constitute, so to speak, standard work. They are performed at the request of manufacturers, clubs, independent investigators, and other interested parties on condition of payment for the actual cost of the work. They, therefore, contribute to the support of the establishment.

The tests of verification, however, notwithstanding their great utility, do not constitute either the most important or the most interesting work of the laboratory. The *research work*, which prosecutes continuously and patiently systematic, thorough and

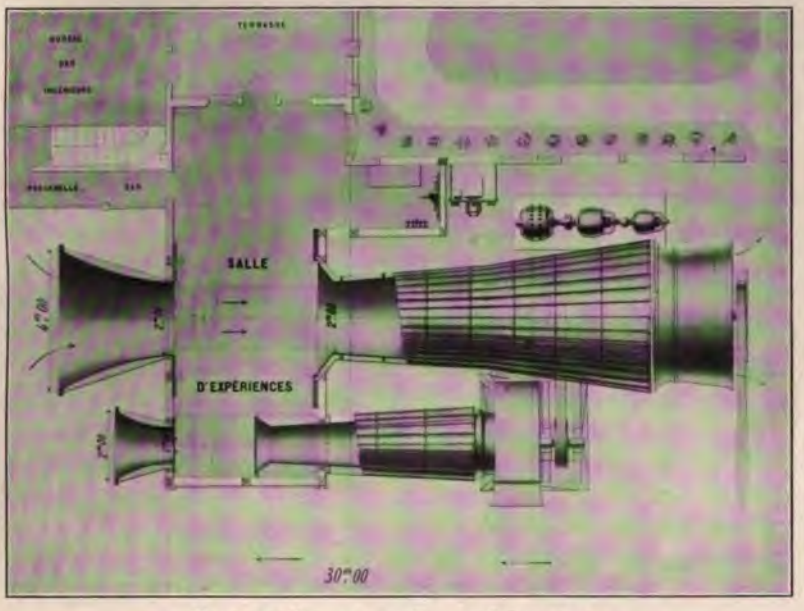
THE ROLLING TRUCK TESTS AT ST. CYR.

precise investigation of new ideas, or of old ideas with new applications, with the specific intention of discovering laws and formulae for advancing progress of aerial navigation, is of greater importance, because it is the short cut to substantial efficiency, economy, improvement and prestige.

This work is concerned with developing adequate methods of research in all branches of aerial navigation, and in furnishing reliable information to all students, engineers, inventors, manufacturers, pilots, navigators, strategists and statesmen. The knowledge thus gained should be disseminated regularly through publications, lectures, open-air demonstrations, and by exhibitions

of apparatus, instruments, materials and models—in fact, by all the facilities of the aerodrome, the showroom, the library and the lecture room.

An exact knowledge of aerodynamics can be best acquired in such a laboratory by experimentation with standard scale models in air tunnels, such as those used by M. Eiffel, and others. In this way reliable data is obtained of the air resistance to be encountered, and the efficiency at various velocities, the amount of



PLAN OF PORTION OF EIFFEL LABORATORY.

lift, the effect of varying impact at different angles of attack on the stability, in fact all the exact data which, reduced to curves and diagrams, enables the engineer to design a machine in a scientific manner. From such data the performance of a new machine can be closely predicated. The performance of the finished product can be verified, later, as before described.

Much of the research work will be prosecuted at the request of technical men outside of the institution to whom the laboratory should offer, gratuitously as far as possible, its material and personal resources.

THE COUNCIL AND ORGANIZATION.

To obtain benefit from these researches it will be necessary to know that they are worth the time and expense, and a body of men —a *council* or a *board of governors*—should be authorized to accept or reject requests for this work. This will be a delicate task, but the principal duty of the council should be to establish and to correct, from time to time, a program of the research work to be executed by the *director* and *his staff*, and to co-ordinate the work to the best advantages within the limits of the money available. The disbursement of the government funds, however, and the responsibility therefor should be entirely under the director.

With the actual state of aerial navigation and its deficiencies as a guide, it will be the policy of the council to concentrate effort upon such points as seem most important, promising and interesting for the time being.

I do not think there would be any doubt, if we had the laboratory in working order now, but that all questions relating to improvement in stability, automatic control, and safety in general would have the right of way.

The council or board, which in England is called the " advisory committee," should be representative of other government departments than that employing the director, and should be independent of the director and his administrative staff. It might be possible for the director to act as a member of the council, and if so, it would conduce to harmony and expedition.

The council should not be a large body, but should be composed mostly of specialists of unquestioned ability, men interested in the sane development of aerial navigation in various branches of the government, and in its useful and safe adaptation to commerce and sport.

Whatever the ability of this council, it should not be allowed to pretend that it has a monopoly of aeronautic acumen. Many brilliant and worthy ideas may originate outside of the establishment which it will be wise to investigate. And to avoid any possibility of the council being charged with narrow prejudice, it is indispensible that it be not composed entirely of specialists. In a few words, it should comprise representative men, who are also learned and technical men, with broad vision and reputation, whose

presence will guarantee to industrial investigators that their ideas will be treated in an unpartisan or unbiased spirit. I will not attempt to suggest the composition of this council or board, but it is evident that the army and the navy should each be adequately represented on it.

ENDOWMENTS, PRIZES, AND REWARDS.

If the laboratory should obtain, in addition to the funds required for prosecuting researches by its staff, any endowments of financial aid in excess of immediate needs (and I am confident it will eventually), it would accomplish useful work by offering prizes and granting rewards for important results achieved outside of the institution. The division of rewards would be one of the functions of the council, and it is possible that this would be one of the best uses of such resources, after the success of the laboratory is assured.

The *complete rôle* of an ideal aerodynamic laboratory can be summed up now in a few words in the natural order of establishment: (1) Execution of verification tests by means of nominal fees; (2) Facilities to technical men for prosecuting original researches; (3) Execution of researches in accordance with a program arranged by the council; and (4) Reward of commendable results accomplished outside of the laboratory.

NATURE OF THE PLANT.

Researches and tests can be made on either a large or a small scale, preferably on both.

The use of small models can be made prolific in results because of the comparatively small cost, provided we understand the laws governing transformation into the full sized products. For model work a large plant is unnecessary. M. Eiffel has done very valuable work in a very small establishment.

Certain classes of tests with large models, such for example as the block test of propellers, do not require much space. But the conditions are altered when such tests are made on a machine in motion. These more difficult tests are absolutely indispensable, and very important to the usefulness of an official laboratory.

Experiments and tests with small models being comparatively inexpensive, private establishments often undertake their execu-

tion, but when we attempt to draw conclusions from their results, we are obliged to admit that the laws of comparison with full-sized machines are debatable the world over. Comparisons are sensibly true between small surfaces and larger surfaces that have been extended proportionately to the square of the linear dimensions, even to surfaces five or ten times larger, but when we pass to much larger surfaces, as we are obliged to, we are forced to adopt formulae with empirical coefficients about which there is indefinite dispute.

A MODEL NIEUPORT MONOPLANE.

The difficulty can be overcome only by precise experiments upon large surfaces, and such experiments, whatever the manner in which they are performed, will be costly. If privately executed, the financial returns would not cover the cost.

The laboratory should comprise, therefore, two distinct parts, one devoted to experiments on small scale models, and the other to experiments on surfaces of large dimensions. But in both parts precise and thorough work is necessary.

When we have studied separately each element, of an aeroplane, for example, it will be necessary to test the complete apparatus. An aerodrome annex is, therefore, necessary, or, at least, the

laboratory should be located in proximity to an aerodrome of which it can make use. In order that the observations may not only be qualitative but quantitative, it will be necessary to follow all the movements of the complete machine, to know at each instant the speed, the inclination, the thrust of the propellers, the effective horsepower, and , in fact, to conduct a true open air laboratory for

TESTING THE CURTISS HYDROAEROPLANE MODEL AT THE MODEL BASIN, NAVY YARD, WASHINGTON, D. C.

aircraft, after the manner of certain tests that have been prolific of results in France.

The English have established close relations between the Royal Aircraft Factory and their laboratory, the function of the former being that of the reconstruction and repair of aeroplanes, the test of motors, and the instruction of mechanics.

LOCATION OF THE LABORATORY.

The location of the model testing plant, the headquarters of the administration staff, requires comparatively small space, and there is no reason why it should be remote from a city, or from intellectual and material resources. It is advantageous to have it easy of access to many interested people who are not attached to it.

The location of the open-air laboratory should obviously be at an aerodrome, as near as may be convenient to the model testing plant or headquarters. Close proximity of the two parts is desirable but not necessary. The high price of land near a large city obliges the aerodrome annex of foreign plants to be located at a distance, but we are fortunate in having here, at Washington, ideal conditions for the location of both barts. The model laboratory should obviously be located on the site of Langley's notable work at the Smithsonian Institution where the nucleus, an extensive library of records, and certain collection of instruments are still available. The National Museum is also an ideal location for the historical collection of models that will result.

No more ideal location for the annex, the open-air laboratory or aerodrome, exists in all the world than that afforded by the, as yet undeveloped, extension of Potomac Park. This is government property, which is of doubtful utility as a park only, but which would be of immense utility and interest as a park combined with a scientific plant of the character under consideration.

There is no reason why the public should be excluded from such a practice field, but there is much to recommend that it be open to the public under proper regulations as to the traffic, especially on occasion of certain tests or flights of an educational value. It is of sufficient area, about one square mile. It is about two miles long, is almost entirely surrounded by broad expanses of water, and while convenient of access, is so situated that the public may be readily excluded when tests of a dangerous character are in process of execution. The fine driveways that will be required as a park will offer excellent facilities for the practice work of the aerodrome and for the moving test cars that should be supplied.

One of the most attractive features of this location is the advantage it offers as an ideal aerodrome for both the army and the navy, for both land and water flying, and the opportunity it affords

for co-operation in all branches of the work of instruction and experimentation. Furthermore, it is near to the shop facilities of the navy yard, the accommodations of the Washington Barracks, the conveniences of the various government hospitals, and it would doubtless add to the information and interest of the nearby War College Staff and the General Board of the Navy. Its location would enable our statesmen in Congress, and a great number of the officials in all departments to keep in touch at first hand with the progress of aeronautics, with the quality of the work done, and with the manner in which the money appropriated was being expended. The educational facilities offered by the work and by the lectures would be invaluable to the course of instruction for army, navy and civil students of aeronautics.

As Washington is a mecca for business people of all parts of the country, a laboratory located here would be convenient in a commercial sense, especially in view of its southerly location, which renders the open aerodrome available for use throughout the greater part of the year. The only objection that I can see to the Potomac Park extension is that the ground will require a considerable clearing, but the trees on the harbor site of the location would not necessarily require removal.

THE APPARATUS NEEDED.

It is useless to discuss here the various instruments and methods which have been subjects of some dispute abroad. All have some good feature, but time has shown where some of the cumbersome and unnecessary installations may be eliminated to advantage and where others may be improved. The new plant of M. Eiffel, at Anteuil, may be regarded as a model for the wind tunnel and the aerodynamic balance. A duplicate of that plant alone would be of inestimable value. The last volume published by M. Eiffel is a forcible example of the value of his discoveries, by this method, with respect to the angle of incidence and the displacements of the center of pressure. It seems to merit the utmost confidence, although the details of his installation differ from those at Chalais, at Koutchino, at the Italian laboratory, and others. This method permits of testing the resistance of body structures, the sustaining power of surfaces, the tractive power of propellers, and the influence of transverse or oblique currents. If a "free drop" apparatus at uniform speed be regarded as indispensable to obtain-

ing the coefficients of air resistance to solid bodies of different shapes, it is possible that the interior of the Washington Monument could be used to advantage, as was the Eiffel tower, without disturbance of the main function of that noble structure. This would be an excellent place from which to observe the stability or action of falling models cast adrift at an altitude of 500 feet, under varying atmospheric conditions. The free drop of full-sized models would, of course, require the use of kites or captive balloons.

THE SUCTION BLOWER AT THE END OF THE WIND TUNNEL.
(In the new laboratory of M. Eiffel at Anteuil.)

The moving car, previously referred to for tests of verification, would be the most useful open-air plant and would soon repay the outlay required by the value of the information obtained from its use. A miniature duplicate of this method for preliminary tests on models with a wire trolley would be of value in a hall of large dimensions. It would be useful in winter work, but not invaluable.

The track of the open-air vehicle at St. Cyr is too restricted to give the best results. The car cannot circulate continuously at high

speed and maintain the speed for a sufficient length of time. An ideal endless track may readily be arranged at the Potomac Park extension, preferably of rectangular form with rounded corners. A railway track would be preferable, but excellent results could be obtained from autotrucks run on macadamized road-beds. Good results could be obtained by the use of suitable hydroaeroplanes or flying boats suitably equipped with instruments.

At the aerodrome annex ample facilities should be provided for measuring the wind velocity at various heights and at different points. The convenient installation of recording anemometers and the employment of kites or captive balloons should be considered.

A branch of the U. S. Weather Bureau could readily be established at the aerodrome here in connection with the investigation of meteorological phenomena affecting the movements of aeroplanes in flight, and as an adjunct to the national laboratory.

Exactly measured bases and posts of observation are also required, as well as instruments of vision or photographic apparatus, to permit of following machines in their flights and of preserving the records for study.

One of the most useful installations for recording advanced information is an actual aeroplane itself equipped with instruments adapted to record, while in flight, much of the information that is desired. Such a machine is already in use in France and in England.

It will be in perfect harmony and convenient to the laboratory to obtain all the services of an aircraft factory for the Washington navy yard, where facilities already exist for the reconstruction and repair of aeroplanes, the test of motors, and the instruction of mechanics. But this should not be allowed to interfere with our policy of relying upon private industry for the purchase of new machines for the sake of encouraging the art among private builders.

It will suffice to merely mention the hangers or sheds required, or the local accessories, such as drafting rooms, offices, and minor repair shops. The character and location of these present no difficulties, but they should not be made the principal part of the institution as they are in several elaborately equipped foreign laboratories. The power plant, however, is a subject for careful consideration, and the economy effected by M. Eiffel in his new installation at Anteuil is worthy of study.

COST.

I have seen estimates varying from $250,000 to $500,000 for such a plant, but inasmuch as $100,000, with an annuity of $3000, donated by M. Henry Deutsch de la Meurthe, to the University of Paris, for the establishment of the aeronautical laboratory at St. Cyr, seems to have been sufficient for a very creditable though somewhat deficient plant, I will venture an opinion that $200,000 would be sufficient in our case. Although the same plant would cost more in this country, I assume that some of the buildings required are already available at the Smithsonian Institution. If located elsewhere, the cost would be considerably more than the sum named.

A COMMISSION RECOMMENDED.

Inasmuch as more definite information regarding the actual cost of a dignified and creditable, but modest and sufficient installation should be obtained, and as the details of the plan, the scope, the organization and the location of such an important undertaking should not be left to the recommendations of one man, a commission or board should be appointed to consider and report to the President, for recommendation to Congress, on the necessity or desirability for the establishment of a national aerodynamic laboratory and on its scope, its organization, the most suitable location for it, and the cost of its installation.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

STAR IDENTIFICATION.*

By CAPTAIN HARRY S. KNAPP, U. S. Navy.

Hydrographic Office publication No. 1560, listed in Portfolio No. 1 of every station chart catalogue under the title Diagram for the Graphical Solution of Triangles, though its real title is Graphical Method* for Navigators, by Commander (now Rear-Admiral, retired) C. D. Sigsbee, U. S. Navy, has proved so useful to me for one particular purpose that I venture to invite the attention of the service to it. If any excuse is needed, it may be found in the fact that I have not yet run across anybody in the service who had used the diagram for the particular end in view until after I had spoken of it.

Every navigator who employs twilight sights appreciates any method by which a star or planet can be unhesitatingly identified, whatever the conditions of cloudiness or light. This is particularly the case at evening twilight, when the brightest stars may often be detected in broad daylight while the horizon is excellent, though the lesser stars of the constellations are still invisible. The identification can be made by waiting, if cloudiness does not intervene; or, with a loss of time, by other known methods, if the azimuth is made a part of the observation. A few minutes' work *beforehand* with the Sigsbee Diagram will enable the navigator to identify his star at once on sight; more than that, it will enable him to look for his star early in exactly the right place. I have myself frequently set my sextant and found a star by sweeping

* Navigators interested in graphical methods are also referred to an article in the PROCEEDINGS of Dec. 1908, No. 128, entitled "The Azimuth Diagram and Its Availability for the Solution of Various Problems in Navigation," and to the use of "The Azimuth Diagrams," of Captain Weir, which diagrams are found in all chart outfits.

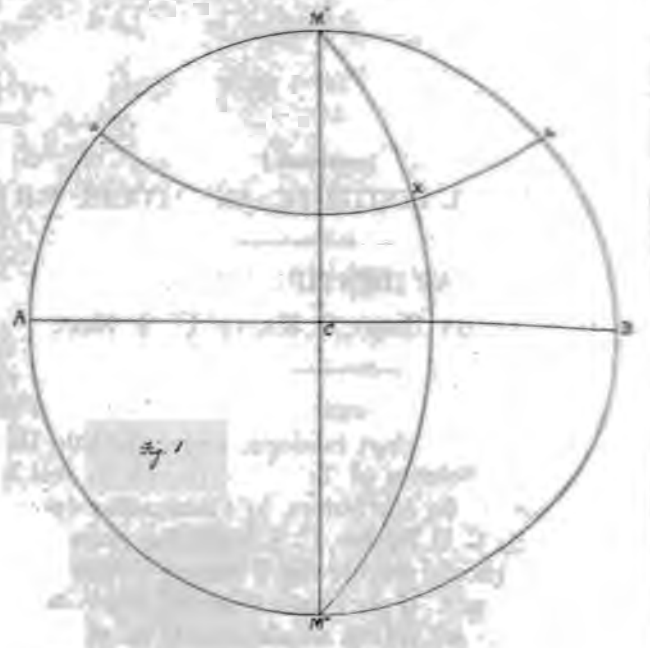

Fig. 1

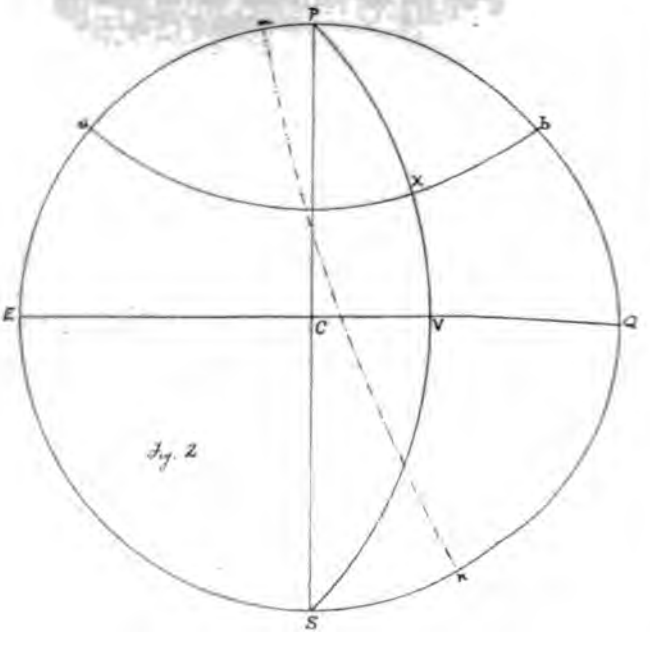

Fig. 2

the star was invisible in the sky, and I have seen others do me thing.

Sigsbee Diagram is a stereographic projection, on the plane meridian, of (a) the great circles traced by planes all pass- rough a common axis, which is also one axis of the meridian, f (b) the one great circle and (c) the small circles traced nes at right angles to this common axis. In Fig. 1, which incomplete diagram, the primitive, or bounding circle, ′′*A* is the celestial meridian, *M′XM″* is one of (a) the

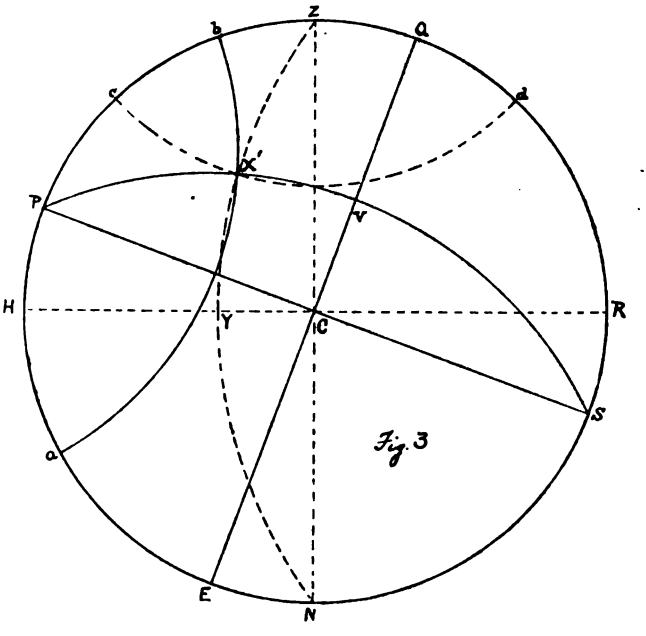

Fig. 3

circles passing through the common axis *M′M″*, *ACB* is (b) e great circle, and *aXb* is one of (c) the small circles traced nes at right angles to the common axis *M′M″*. In the com- diagram, the great circles through the axis and the small at right angles to it are all drawn at intervals of one degree the diagram permits it without undue crowding of lines. the common axis passes through the poles, the first (a) ur circles (meridians), the second (b) is the equator, and ird (c) are declination or latitude circles. Thus in Fig. 2, ch the full lines are exactly the same as in Fig. 1, but with

different lettering, P is the elevated pole, S the depressed pole, PXS is an hour circle, EQ is the equator, and aXb is a circle of declination. If (2) the common axis passes through the zenith and nadir, the first (a) are azimuth circles, the second (b) is the horizon, and the third (c) are altitude circles. Thus in Fig. 3, Z is the zenith, N the nadir, and of the dotted lines HR is the horizon, $ZX'N$ is an azimuth circle, and $cX'd$ is an altitude circle. To use the diagram, there are only needed a sheet of tracing paper and a pencil; the rest of the work is arithmetical, or a matter of manipulation.

If the declination and hour angle of a heavenly body are known, its projection can be plotted on the diagram considered as made on assumption (1) above; if the altitude and azimuth of the same heavenly body are known its projection can equally be plotted on the diagram considered as made on assumption (2) above. If either set of co-ordinates is known, and the latitude as well, the other set of co-ordinates may be found corresponding to the same instant. The application of this general principle will be made in the solution of the particular problem in mind, and incidentally the method of using the diagram will be apparent.

The problem may be stated thus: At morning or evening twilights, what navigational stars or planets will be visible, if clear, and what will be the approximate altitude and azimuth of each? The known data are: the latitude, the hour angle, and the tabulated declinations of the stars and planets.

The hour angle is found by applying the right ascension of the mean sun to the mean time of twilight, morning or evening (say 20 minutes after sunset and 20 minutes before sunrise), thus getting the sidereal time of the hour when observations can suitably be taken. It is not necessary to work closely for the purpose in view, and seconds of time may be ignored. Applying to the sidereal time of twilight the right ascension of any heavenly body gives its hour angle at twilight. With the sidereal time of twilight as a constant, the hour angles of all the navigational stars can be computed mentally by running down the table of mean places.

The solution of the problem is as follows: Put the tracing paper over the diagram, temporarily secured. Now considering the diagram as the projection in which the common axis of intersecting great circles (meridians) passes through the poles and the

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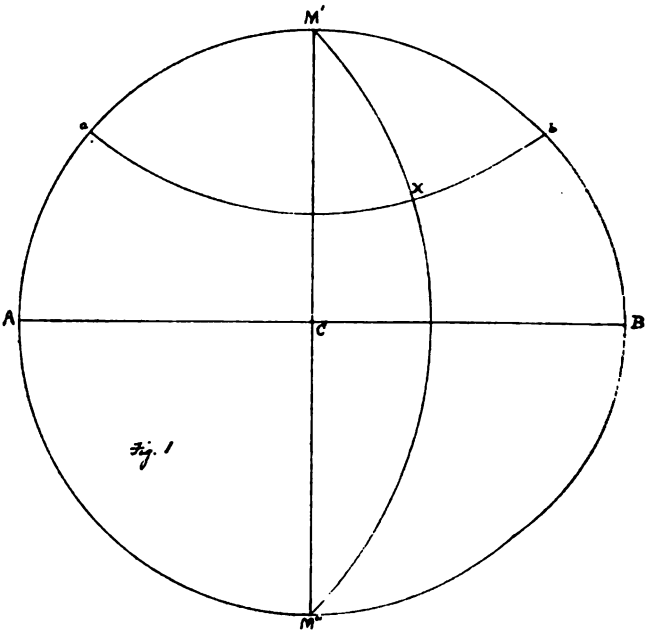

Fig. 1

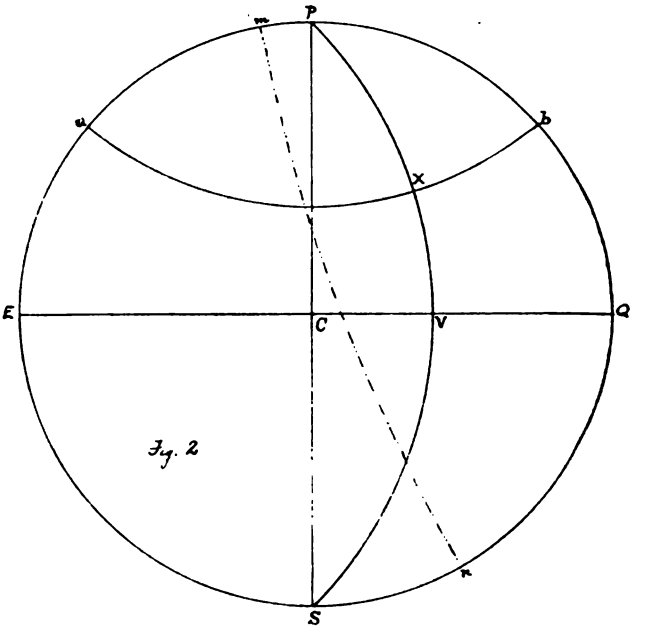

Fig. 2

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The Sigsbee Diagram is a stereographic projection, on the plane of the meridian, of (a) the great circles traced by planes all passing through a common axis, which is also one axis of the meridian, and of (b) the one great circle and (c) the small circles traced by planes at right angles to this common axis. In Fig. 1, which is an incomplete diagram, the primitive, or bounding circle, $M'BM''A$ is the celestial meridian, $M'XM''$ is one of (a) the

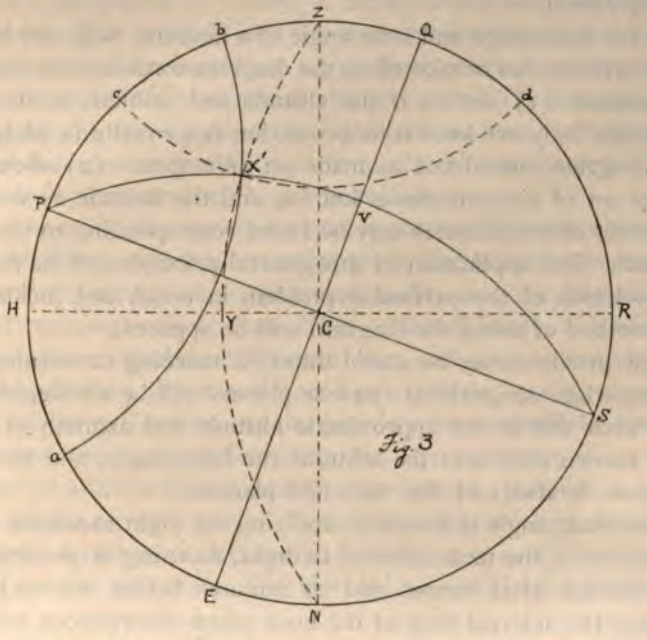


Fig. 3

great circles passing through the common axis $M'M''$, ACB is (b) the one great circle, and aXb is one of (c) the small circles traced by planes at right angles to the common axis $M'M''$. In the complete diagram, the great circles through the axis and the small circles at right angles to it are all drawn at intervals of one degree where the diagram permits it without undue crowding of lines. If (1) the common axis passes through the poles, the first (a) are hour circles (meridians), the second (b) is the equator, and the third (c) are declination or latitude circles. Thus in Fig. 2, in which the full lines are exactly the same as in Fig. 1, but with

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A GRAPHIC METHOD FOR DETERMINING THE ALTITUDE OF AEROPLANES.

By Prof. Giuseppe Pesci, of the Royal Naval Academy at Leghorn.

Translated from *Rivista Tecnica di Aeronautica*, N. 3, May–June, 1911, By F. W. Morrison and C. W. Frederick.

1. The altitude of an aeroplane may be determined in the following manner:*

Establish a horizontal base AB (Fig. 1), and let P be the aeroplane, and H its projection on the horizontal plane passing through AB. With two theodolites measure the angles of elevation

$$HAP=\alpha', \qquad HBP=\beta',$$

and the angles in azimuth

$$HAB=\alpha, \qquad HBA=\beta.$$

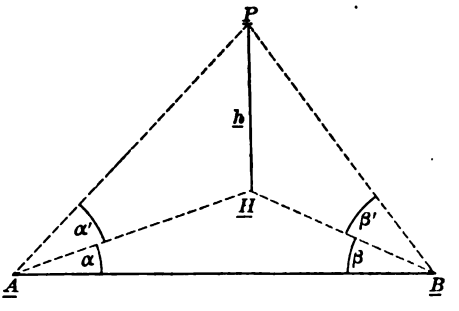


Fig. 1.

Then, assuming AB as the unit of length, let

$$\frac{HP}{AB}=h, \qquad \frac{AH}{AB}=m, \qquad \frac{BH}{AB}=n.$$

*Henri Petit: *Comment on mesure l'altitude atteinte par les aéroplanes.* "La Nature," 19 Novembre, 1910.

By trigonometry we have at once

$$m = \frac{\sin \beta}{\sin (\alpha+\beta)}, \tag{1}$$

$$n = \frac{\sin \alpha}{\sin (\alpha+\beta)}, \tag{2}$$

$$h = m \tan \alpha', \tag{3}$$

$$h = n \tan \beta', \tag{4}$$

whence

$$h = \frac{\sin \beta \tan \alpha'}{(\sin \alpha+\beta)} \tag{5}$$

or

$$h = \frac{\sin \alpha \tan \beta'}{\sin (\alpha+\beta)}. \tag{6}$$

We propose to construct a nomogram which will do away with the numerical computation of the above formulæ. Among the different types that might serve for such a purpose, we believe the most suitable is that obtained by superposing two nomograms with circular scales.* The principle of their construction is so simple that it can be understood even by those who are unacquainted with the elements of nomography. Thus we hope to increase to some extent the interest in this new and fertile science.

NOTE.—It would evidently be sufficient to know only one of the two angles α' or β', but it is well to know them both, either to serve as a check upon the two values of h which can be obtained in this way, or for cases where the sine of one of the two angles α' or β' may be indeterminate.

2. In the equation

$$f_1 f_2 + f_3 = 0 \tag{7}$$

let f_1 represent *any* function of a single independent variable x_1, and similarly let f_2 be any function of x_2, and f_3 of x_3. The equation can be written in the form of a determinate as follows:

$$\begin{vmatrix} 1 & f_1 & 1+f_1^2 \\ 1 & f_2 & 1+f_2^2 \\ 1 & 0 & 1+f_3 \end{vmatrix} = 0, \tag{7'}$$

* Nomograms of superposed conical scales were brought to notice by Clark, Professor at the Politecnico di Cairo. See *Théorie générale des abaques d'alignement*. "Revue de Mécanique," 1907. Also see D'Ocagne, *Calcule graphique et Nomographie*. "Encyclopédie scientifique", Doin.

as may be easily verified. Then referring to a system of rectangular axes,* the three points

$$x_1 = \frac{1}{1+f_1} \qquad y_1 = \frac{f_1}{1+f_1^2}, \tag{8}$$

$$x_2 = \frac{1}{1+f_2} \qquad y_2 = \frac{f_2}{1+f_2^2}, \tag{9}$$

$$x_3 = \frac{1}{1+f_3} \qquad y_3 = 0 \tag{10}$$

are seen to be in a straight line. From (8) it is clear that upon varying z_1 the locus of the points (x_1, y_1) is a circle, for by eliminating f_1 we obtain

$$x^2+y^2-x=0.$$

From (9), upon varying z_2, the locus of the points (x_2, y_2) is the same circle. And from (10), varying z_3, the locus of the points (x_3, y_3) is the axis of abscissas.

Having shown this, let us give to z_1 a series of values (in arithmetical progression, for example), and by means of equations (8) compute the coordinates (x_1, y_1) corresponding to each value of z_1. When we plot these points they will fall on the circle mentioned above, and we may assign to each the corresponding value of z_1, which will then be its scale value. Thus we obtain scale (z_1). Similarly if we vary z_2, we shall obtain scale (z_2), upon the same circle. And by varying z_3, we shall obtain scale (z_3), upon the axis of abscissas. These three scales, when plotted, constitute a nomogram.

It is now evident that, given two of the three quantities z_1, z_2, z_3, which satisfy equation (7), as z_1 and z_3, in order to obtain the third, we determine the point of scale (z_1) which represents the scale reading z_1, and the point of scale (z_3) which represents the reading z_3. The straight line joining these two points will intersect the scale (z_2) at a point the scale reading of which will be the required value of z_2.

The reading of the scales will generally require an interpolation by eye.

NOTE I.—The accuracy attained will always depend upon the dimensions of the figure.

NOTE II.—To construct the scales (z) we could also proceed graphically,† but for the sake of accuracy, and the checking of

* D'Ocagne, see p. 289.

† D'Ocagne, see pp. 171 and 290.

the figure, it is best to compute all three of the scales numerically from the equations (8), (9), and (10).

NOTE III.—Instead of tracing the connecting line upon the design, it is better to use a fine thread.

3. With the above as a basis, we see that by introducing two arbitrary constants k_1 and k_2 we may write equation (1) in the form

$$k_1 m \frac{k_2}{k_1} \sin(\alpha+\beta) - k_2 \sin\beta = 0,$$

which is similar to equation (7), if we make

$$z_1 = m \qquad f_1 = +k_1 m,$$

$$z_2 = \alpha+\beta \qquad f_2 = -\frac{k_2}{k_1}\sin(\alpha+\beta),$$

$$z_3 = \beta \qquad f = +k_2 \sin\beta.$$

With these [or similar equations from (2)] we can construct a nomogram as explained in the previous paragraph.

Introducing another arbitrary constant l, the scales of this nomogram may be computed by writing equations (8), (9) and (10) in the following form:

$$x_1 = +\frac{l}{1+(k_1 m)^2} \qquad y_1 = +\frac{l k_1 m}{1+(k_1 m)^2}, \tag{11}$$

$$x_2 = +\frac{l}{1+\left(\frac{k_2}{k_1}\right)^2 \sin^2(\alpha+\beta)} \qquad y_2 = -\frac{l\frac{k_2}{k_1}\sin(\alpha+\beta)}{1+\left(\frac{k_2}{k_1}\right)^2 \sin^2(\alpha+\beta)}, \tag{12}$$

$$x_3 = +\frac{l}{1+k_2 \sin\beta} \qquad y_3 = 0. \tag{13}$$

The common basis of the two scales (m) and $(\alpha+\beta)$ will be a circle with center at $\left(\frac{l}{2}, 0\right)$, and radius $\frac{l}{2}$.

Thus we obtain Fig. 2, in which we have taken $l=4$ cm. and $k_1=k_2=1$. From this nomogram, if we put $\alpha=130°$, and $\beta=30°$, we find $m=1.4$.

NOTE I.—The values of y_1 and y_2 can be obtained from those of x_1 and x_2 by noting that

$$y_1 = [k_1 m] x_1, \qquad y_2 = -\left[\frac{k_2}{k_1}\sin(\alpha+\beta)\right] x_2,$$

and the computation of x_2 can be simplified through the well-known relation

$$\sin^2(\alpha+\beta)=\tfrac{1}{2}[1-\cos 2(\alpha+\beta)].$$

NOTE II.—Having computed scale (β), the scale $(\alpha+\beta)$ may be obtained from it, for when $m=1$ we have from equation (1) $\sin\beta=\sin(\alpha+\beta)$, whence reducing $(\alpha+\beta)$ to the first quadrant (if necessary), the points of the two scales having the same value must fall on a straight line with the point $m=1$. For the sake of accuracy, however, it is advisable to make use of this property only as a check upon the computations.

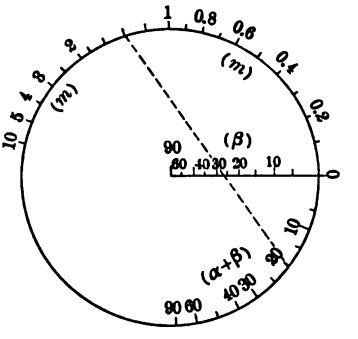


FIG. 2.

4. Introducing another arbitrary constant k_3, the equation (3) can be put in the form

$$k_1 m \frac{k_3}{k_1}\frac{1}{h} - k_3 \cot\alpha' = 0,$$

which is similar to equation (7), if we put

$$z_1=m \qquad f_1=+k_1 m,$$

$$z_2=h \qquad f_2=-\frac{k_3}{k_1}\frac{1}{h},$$

$$z_3=\alpha' \qquad f_3=+k_3\cot\alpha'.$$

With the above [or similar equations from (4)] we can construct a nomogram like the preceding one. If we give to l and k_1 the same values they had in the preceding case, the new scale (m) will be the same as before.

Scales (h) and (α') are then obtained from the formulæ

$$x_4 = + \frac{l}{1 + \left(\frac{k_2}{k_1}\right)^2 \frac{1}{h^2}} \qquad y_4 = - \frac{l \frac{k_2}{k_1} \frac{1}{h}}{1 + \left(\frac{k_2}{k_1}\right)^2 \frac{1}{h^2}}, \qquad (14)$$

$$x_5 = + \frac{l}{1 + k_2 \cot \alpha'} \qquad y_5 = 0, \qquad (15)$$

Thus we construct Fig. 3, in which l and k_1 have the same value as in the preceding figure, and $k_2 = 1$. From this nomogram, if we put $m = 1.4$ and $\alpha' = 50°$, we find $h = 1.6$.

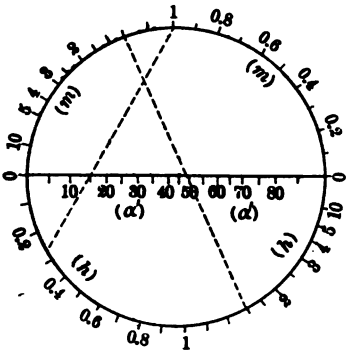


FIG. 3.

NOTE I.—The values of y may be obtained by noting that

$$y_4 = - \left[\frac{k_2}{k_1} \frac{1}{h}\right] x_4.$$

Also, having constructed the scale (α') from 0° to 45°, we see that when $k_2 = 1$ the remaining part of the scale is symmetrical with the first in respect to the center of the circle, for it is evident

$$\frac{l}{1 + \cot \alpha'} + \frac{l}{1 + \cot (90° - \alpha')} = l.$$

NOTE II.—If it were not for the checking mentioned before (Art. 2, Note II, and Art. 3, Note II), having computed scale (m), the calculation of scale (h) would be unnecessary, for two reasons: First, when $\alpha' = 45°$ we have $h = m$; consequently the points which in the two scales have equal values, are in a straight

line with the point $a'=45°$. Second (true only when $k_3=1$), for equal values of h and m we have

$$x_1+x_4=l \quad \text{and} \quad y_1=-y_4;$$

hence scale (h) is the same as scale (m) revolved 180° about the center of the circle.

5. In Fig. 4 the two preceding nomograms are superposed and drawn to a larger scale (making $l=6$ cm. instead of $l=4$ cm. to show the details of the figure more clearly), and since the problem requires h only, the common scale (m) is left blank. The resulting abacus is a circular one of double alignment and four variables.*

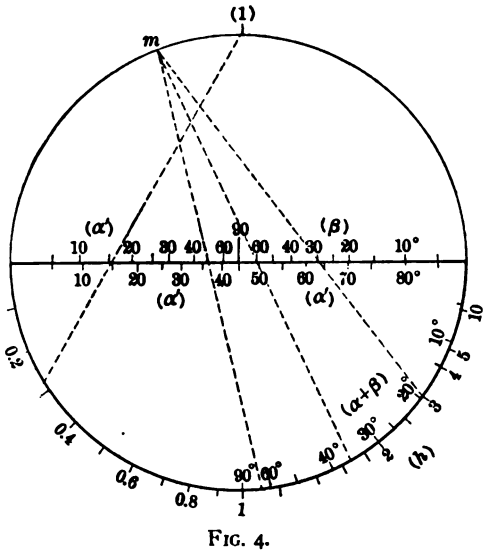


FIG. 4.

From the preceding we see that if we have given a, β and a' to find h, we first join the point $a+\beta$ of the scale $(a+\beta)$ to the point β of the scale (β) by means of a straight line, and thus determine another point where this connecting line cuts the circle [this point would give the value of m, if we had constructed the scale (m)]. Next we join this point to the point a' of the scale (a') by means of a straight line, and the point at which this connecting line cuts scale (h) gives the required value of h.

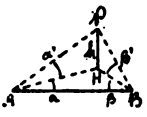
From the above figure, when $a=130°$, $\beta=30°$, $a'=50°$, we find $h=1.7$

* D'Ocagne, see p. 330.

Abbaco

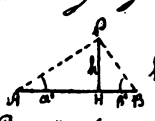
per il calcolo dell'altezza di un aeroplan

(L'unità di lunghezza è la base AB)



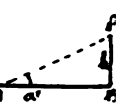
$h = \frac{\text{sen}\alpha \text{ sen}\beta \text{ cos}\alpha'}{\text{sen}(\alpha+\beta)}$

Es (retta I): $\alpha = 130°$ $\beta = 30°$, $\alpha' = 50°$; $h = 1.75$

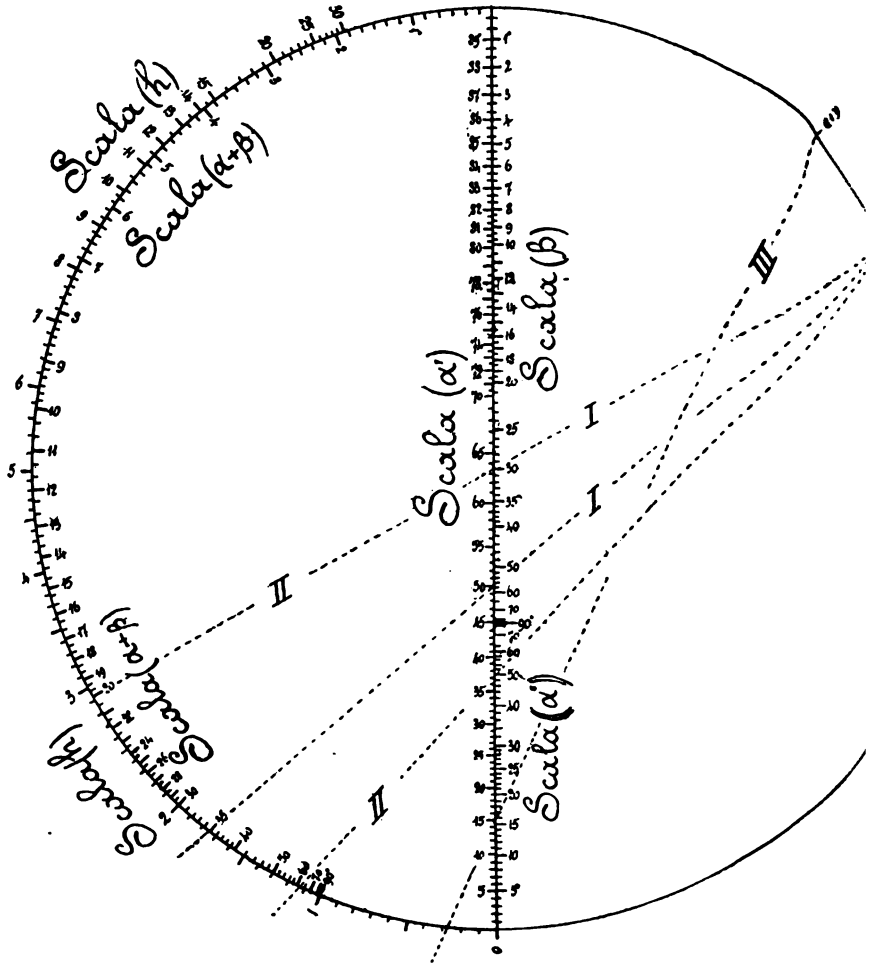


$h = \frac{\text{sen}\alpha \text{ sen}\beta \text{ cos}\alpha'}{\text{sen}(\alpha'-\beta')}$

Es (retta II): $\alpha' = 130°$, $\beta = 30°$: $h = 1.12$



Es (retta III):



The coefficient l has been taken equal to 20 cm., but with a design four or five times this size we could certainly reach approximations, in portions of the base AB, of $\frac{1}{100}$ when h is between 0 and 5, $\frac{1}{80}$ when h is between 5 and 10, $\frac{1}{25}$ when h is between 10 and 15, and $\frac{1}{10}$ when h is between 15 and 30, and, considering the nature of the problem, especially the instability of the point observed, with a base AB not less than 50 m., this degree of accuracy is more than sufficient.*

From what has been said in Note III to Art. 2, and also in Art. 5, the nomogram can be used in the following manner: Hold a thread at the point $\alpha+\beta$ with the left hand; then keeping it taut with the right hand, revolve until it passes through the point β. Then, without releasing it, hold the thread with the right hand at the point where it cut the circle, and keeping it taut with the left hand revolve it again until it passes through the point α'. The final intersection of the thread with the circle will be the point whose scale reading will give the value of h. This would be the process for the general case of Art. 5, and similarly for the cases of Art. 6, and Art. 7.

Thus in the example of Art. 5, viz., given $\alpha=130°$, $\beta=30°$, and $\alpha'=50°$, we find with greater precision (see the dotted lines I) $h=1.75$.

In the example of Art. 6, viz., given $\alpha'=130°$ and $\beta'=30°$, we find the more exact value (see the dotted lines II) $h=1.12$.

And in that of Art. 7, viz., given $\alpha'=15°$, we find (see the dotted line III) $h=0.27$.

These examples are sufficient to show how to proceed in every case.

NOTE I.—For the computation of y_1, y_2, x_2, and y_4, the simplifications indicated in Note I to both Art. 3 and Art. 4 still hold. But those indicated for the computation of scale (α') in Note I to Art. 4, and for $((\alpha'))$ in the Note to Art. 6, are no longer possible. And if scale (m) is not computed, the simplification mentioned in Note II to Art. 4 has no basis.

* A closer approximation can only be deceptive, and in this connection M. Petit (q. v.) wisely remarks, "Appearances of accuracy are attained that are amusing: a recent official record has been announced at 2682 *meters* . . . a little more and they would have given centimeters."

NOTE II.—With a large model the empty spaces might be advantageously filled with directions for the use of the abacus Also there would be room enough to write two sets of supplementary numbers for the corresponding scales, and thus do away with the reduction to the first quadrant in those cases where β or $\alpha+\beta$ is an obtuse angle.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ITALIAN-TURKISH WAR.

(CONTINUED.)

By COMMODORE W. H. BEEHLER, U. S. Navy.

(Compiled and translated from the *Marine Rundschau*, and other sources.)

THE COST OF THE WAR.

The approved estimates in the Italian Parliament, in March, 1912, show that for the period of five months ending February 29, 1912, the current war expenses amounted to $41,495,000, of which $5,790,000 was for the navy, and $35,705,000 for the army; besides which $2,045,800 was expended for special purposes. $18,914,000 of the amount expended for the army included the cost of mobilization and conduct of the war—transportation of troops, maintenance of personnel, purchase of horses, ammunition, and war material—for the troops in Africa; and $11,966,000 was expended to replace the personnel and war material transported to Africa in the standing army in Italy, and for organizing additional forces in Italy.

The $5,790,000 expended for the navy was for the extraordinary expense of maintenance, transportation, the increased complements of ships and subsistence with cost of fuel and material consumed.

The special sum of $2,045,800 was for harbor improvements at Tripoli, Homs, Benghasi and Derna, as well as for telegraph, telephone, and sanitary service in North Africa. This sum also defrayed the cost of laying new cables from Syracuse to Tripoli, and Syracuse to Benghasi.

The expenses of the army and navy thus estimated at $42,140,000 will be covered by the saving in the budget of 1910-11, some $11,172,000, and that of 1911-12—estimated at $14,504,000—together with $16,464,000 to be deducted from the regular budgets in the fiscal years 1912-13 to 1917-18. The apparently low cost of the war has been maintained by the economical administration

of the finances, and this expense amounts to about $260,680 per day. But an accurate estimate of the total cost of the war, of course, cannot be given until after the war is over, because there are many details that are not considered in the present estimates. Expert financiers estimate that the war has in the period ending February 29, 1912, cost a total of $57,900,000, or at a daily rate of $386,000.

The Italian finances were thus in favorable condition, especially as the administration received a large surplus by economy in the budgets during the recent years. The Italian people were willing to make great sacrifices for this war, so that there was no lack of money on the part of Italy to still further prosecute the conquest of Tripoli.

The Turks spent, up to the beginning of February, about twenty million francs chiefly for establishing the new coast defences. February 1, the war minister received an appropriation of $4,43[illegible]r 320 for coast defences.

The friendly offices of neutral powers to re-establish peace between the belligerents failed. On March 9 the diplomatic representatives of Germany, Austria, England, France, and Russia took a united step for this purpose with the Italian government at Rome. They asked confidentially upon what terms Italy would agree to suspend hostilities. The Italian government replied March 15, according to the *Corriere della Sera*, as follows:

Italy demands that Turkey shall recognize Italy's absolute sovereignty over the African provinces and withdraw all Turkish officers and troops from Africa, strictly forbidding Turkish officers to lead the Arabs in opposing the Italians; and Italy will then cease hostilities in all parts of the Turkish empire and reduce the imposts on Turkish goods to the former rates. Italy will, on the other hand, recognize the religious Caliphat and give amnesty to all natives. Italy will assume that part of the Turkish debt apportioned to Tripoli, and will purchase the Turkish government property situated in Tripoli from the Turkish government. Italy further promises to agree, with other powers, to preserve the integrity of the Turkish empire.

The Italian parliamentary discussion proves that the nation fully agreed with the chief demands of the Italian government.

It also appears that Russia had assembled troops on Trans-Caucasian frontier, had recalled the Russian Ambassador Tschary-

kow—who was in Constantinople for many years—and replaced him by Von Giers, the former minister in Bucharest. The Russian press also reported that a Russian fleet was ready to proceed to the Bosphorus in case the Italians forced the passage of the Dardanelles.

The Sultan presented the Shiek of Senoussi with a sword set with diamonds, a decoration, and other precious gifts in gratitude for his support of the war against the Italians.

Turkey replied to Italy's claim by reasserting her claim to full sovereignty over her African provinces, and the Arabians were determined to continue their resistance to the Italian conquest under all conditions. The Arabian representatives in Constantinople declared that they will continue the war even if Turkey yields the annexation of these provinces to Italy.

During the middle of March the Arabians in Tripoli and Cyrenaica elected delegates to the Turkish Parliament in Constantinople, and declared that the Italian proclamation of annexation of these two provinces to Italy was null and void.

MILITARY OPERATIONS UP TO THE MIDDLE OF MARCH, 1912.

The Turks determined to vigorously prosecute the war in Tripoli and Cyrenaica, and incessantly attacked the Italians at all points. At Tripoli the Italians were kept constantly alarmed by these attacks by day and night. The Italians also failed after repeated attempts to capture Zanzur which was occupied by the Turks in force, and which they fortified with artillery and machine guns. In attacks against Zanzur the Italians used, with but little effect, two dirigible balloons arranged for throwing various kinds of bombs and hand grenades.

The Italians collected 3000 burden-bearing camels and 300 riding camels for the camel corps in Tripoli. A battalion of Askaris and a camel riding detachment arrived from Erythrea late in February, and was vigorously attacked by Arabs on March 4 at Bir-el-Turki, the Askaris were routed, and only managed to escape into Tripoli under cover of darkness with heavy losses.

A Turkish attack on Ain Zara was repulsed on March 10. Malarial fever broke out in the camp at Ain Zara, and the garrison was relieved by other Italian troops. A portion of the camp adjoining a swamp was abandoned, and an advanced intrenchment

was captured by the Turks and gave rise to a report that Italians had abandoned Ain Zara.

A narrow-gauge railroad from Tripoli to Ain Zara was completed as far as Fornaci, which is 7 kilometers from Tripoli. The Italians built a field construction railroad to the stone quarries at Gargaresch for stone to build the breakwater at Tripoli.

At dawn of February 27, the Italian garrison at Homs surprised the Turks on the Mergheb heights, about four kilometers from the town and practically commanding the town. The bulk of the Turkish troops had been decoyed from the heights to oppose a feigned landing of Italians from a squadron of transports that appeared off Sliten, about 20 miles east of Homs. The Italians meanwhile intrenched their position on Mergheb heights so that when the bulk of the main body of the Turks returned from Sliten that evening, the Italians defeated them in their efforts to retake the heights. Subsequently the heights were strongly fortified and the Turks could not dislodge the Italians from their commanding position.

There were many fierce combats at Benghasi from March 8 to March 12. After these were repelled General Ameglio led a force of 7 battalions, with cavalry and artillery, to the oasis at Fogat, where he captured 500 Arabs after a desperate resistance. For this brilliant victory Major-General Ameglio was promoted to lieutenant-general.

Attacks by the Turks at Derna on March 3, and at Mirsa Tobruk on March 11 were repulsed with difficulty.

In these engagements in Cyrenaica during the month ending March 15, 1912, the Italians lost 193 killed and 350 wounded.

There was no probability of any decided advance by the Italians into the interior in the immediate future. The commander-in-chief, Lieutenant-General Canera, convinced the government at Rome that successful advances into the interior can only be made very gradually, and must be accompanied by railroad construction that will secure every step that may be gained. The chief of staff, Major-General Gastaldello, who originally advocated vigorously pushing the campaign into the interior, was relieved and replaced by Major-General Ciancio.

There was no probability of any substantial increase to reinforce the 100,000 troops in Africa, March 15.

The reserves serving in Africa were, however, relieved by men of the active army.

A German Red Cross detachment succeeded in reaching Gharian about March 1. This detachment consisted of three surgeons and 12 nurses, two of whom died of typhoid fever en route via Tunis. They attended the sick and wounded in the Turkish camp at Gharian.

At the beginning of April, 1912, the bulk of the Italian naval forces was in the home ports undergoing repairs and recruiting as in peace. Several divisions of torpedo boats and the four auxiliary cruisers, the *Duca-di-Genova, Duca-Degli-Abruzzi, Citta-di-Palermo* and *Citta-di-Messina,* cruised along the Turkish Mediterranean coasts and searched merchant ships of all nationalities for contraband of war. The naval forces stationed off the north coast of Africa participated in small engagements with the land forces on the coast; among other smaller engagements the *Etna* bombarded Hoeifa, a small place near Benghasi.

Vice-Admiral Faravelli was obliged to give up the command on account of a severe nervous ailment, and he was succeeded on April 9, 1912, by Vice-Admiral Viale, who had shortly before this assumed command of the second squadron. Vice-Admiral Amero d'Aste took command of the second squadron.

After the training of the new Italian recruits was completed, the reserves of 1887 were relieved.

The fourth division, comprising three *Garibaldis,* were in the harbors of Cyrenaica, partly at Tobruk and partly in the Gulf of Bomba. It is said that Bomba, which is 55 nautical miles west of Tobruk, will be the future naval port on the African Mediterranean coast. The reason for this change is stated to be that the magnificent harbor of Tobruk lacks adequate supply of potable water, and that there is an ample supply of potable water at Bomba, which can also be easily defended by means of the islands of Menelaus and Bomba that command the approaches to the bay. The depths of water and anchorages are about the same at Tobruk and Bomba, but the serviceable area of the harbor at Bomba is considerably greater. The anchorage at Bomba is only 70 kilometers from Derna, with which it could readily be connected by a railroad. In case Bomba should be selected as the Italian naval port, Tobruk would serve for a base for light naval forces.

As soon as the report of the occupation of Bomba was circulated a large portion of the Turkish-Arabian forces besieging Tobruk was withdrawn to Bomba.

The schoolship squadron of three *Sardegnas* reinforced by two armored cruisers under Vice-Admiral Borea Ricci resumed operations against Zuara. This force was joined by the armored cruisers *Carlo Alberto* and *Marco Polo,* with the auxiliary cruisers *Citta-di-Catania* and *Citta-di-Syracusa,* six torpedo boats, three naval tugs and three transports having the two battalions of grenadiers on board, that sailed from Tripoli westward along the coast on April 8, 1912, for Zuara. En route the latter force bombarded coast places and finally anchored, April 9, 2000 meters distant from the coast in the newly surveyed harbor at Zuara.

The naval vessels began to bombard the town and fired shells all day at intervals of five minutes until night. The next morning 20 armed boats put off from the three transports and, favored by good weather, made a feint at landing. The armored cruisers at the same time vigorously bombarded the town. This bombardment, however, caused no serious damage, but with the feigned landing had the effect of deceiving the enemy and prevented them from opposing the landing of the Garioni division of infantry at a point about 40 kilometers northwest of Zuara. This division of about 10,000 men had embarked at Augusta in 7 transports during the night of April 7, and under the convoy of the schoolship division arrived during the night of April 10 at the peninsula of Macabez on the Tunisian border. With the support of the warships, including a number of torpedo vessels, *Agordat, Iride,* and 6 high-sea torpedo boats, that had sailed from Tripoli and had met the convoy at sea en route. The navy immediately sounded out a channel and a landing place in this difficult locality that enabled the army to begin landing at 3 a. m. and complete the disembarkation the same day without any disturbance by the enemy.

By noon the next day a detachment of naval brigade and Askaris also took possession of the small fort Forwa, or Bu Kamez, at the southern end of the Macabez peninsula about 35 kilometers from Zuara.

The Turkish-Arabian forces did not appear until after the Italians had secured possession of this fort and that attack was repulsed. The Italians then still further fortified their positions

on the peninsula and prepared for their advance upon Zuara from this new base.

A small bay 6 miles long and 1½ miles wide served as a good anchorage for the Italian vessels, and this place has been established as a torpedo boat station for the Italian torpedo craft.

April 12 the Italian military balloons P-2 and P-3 arrived from Tripoli. These balloons had reconnoitered the Turkish-Arabian positions at Zuara, and gave the Italians at Fort Bu Kamez written descriptions of the enemy's strength and positions at Zuara. The balloons then returned off Zuara, where by means of four small anchors, the balloons were anchored close to the Italian warships from which they were supplied with gas and benzine. They then returned to Tripoli, 120 kilometers distant, after an absence from Tripoli of about 12 hours.

The transportation of contraband of war from Tunis via the coast road Ben Gardane was thus cut by the Italian occupation of Bu Kamez. This obliged the contraband trade to take the more difficult and longer route via Dehibat-Nalut, about 150 kilometers further in the interior.

Although reports of Italian operations in the Aegean Sea had subsided the Turks continued to maintain their defences in readiness, especially in regards to the mine fields in the Dardanelles. The Turkish fleet remained inactive in the Straits of Dardanelles, off Nagara.

April 13 the Italian first squadron, consisting of the *Vittorio Emanuele, Roma, Napoli* and three armored cruisers of the *Pisa* class, sailed from Tarento with the *Vettor Pisani,* flagship of the Duke of Abruzzia, and a number of flotillas of torpedo boats. The press reported that this fleet had sailed for Tripolitan waters to relieve the naval vessels operating there, but the fleet went to the Aegean Sea to make a naval demonstration on the Turkish coasts. Simultaneously the second squadron sailed from Tobruk and Augusta for the same destination. This force comprised the flagship *Regina Margherita, Benedetto Brin, St. Bon, E. Filiberto,* three armored cruisers of the *Garibaldi* class, three auxiliary cruisers and three naval colliers.

The fleet united during the night of April 17 near the island of Stampalia, west of Rhodes, and steamed the next morning at a speed of twelve knots to the northern part of the Aegean Sea, with

thence southward towards the western entrance o
nelles with the *Pisa* and *Amalfi* well advanced in o
the Turkish squadron out of the Dardanelles. Ab
Turkish torpedo chaser was sighted off the entran
diately withdrew within the straits upon the app
Garibaldi and *Varese*. The outer Turkish forts the
from the four coast forts of the Dardanelles, Ku
Orhanie on the Asiatic side, and Sedil-Bahr and Er
European side. These partly modern fortifications
heavy Krupp guns of 8-inches to 11-inches caliber.

The Italian ships returned the fire at a range o
meters and fired for a period of two hours. The thre
first division bombarded the two forts on the Euro
the five ships of the second and fourth divisions
forts on the Asiatic side. Turkish reports estim
Italians fired 342 projectiles. The forts, especially I
were severely damaged. The barrack buildings
quently, and in the fort Sedil-Bahr alone the Turk
men killed and 18 wounded.

The Turkish fire was ineffective, about 150 Turki
were fired. The Italian official report states tha
ships sustained no damage, and they expressly denie
reports that the *Varese* had been set on fire by the
jectiles.

The Turks closed the Dardanelles to all shipping

infantry barracks for 1200 men, and completely destroyed them. A Turkish gunboat that was in the harbor was sunk, the Italians claim, by a torpedo fired from the *Ostro,* while the Turks claim she was sunk by her own crew. The Italians departed immediately after sinking the gunboat.

The *Regina Margherita* and *Benedetto Brin,* each with a torpedo boat, cut the cable between Rhodes and Marmarice at both cable landings.

April 19 the main body of the Italian fleet started back to Italy leaving the third division with the *Pisa Amalfi* and a number of flotillas of torpedo boats to operate on the coast of Asia Minor and continue to destroy the cable communications. Among other places attacked they destroyed the telegraph station at Chios and that at Tschesme opposite Chios. They destroyed the radio station at Guelemich, opposite Rhodes, that formerly kept communication with the radio station at Derna, besides which they destroyed a telegraph station at Smyrna. These cable and telegraph stations were partly the property of the Turkish government, and partly belonged to the Eastern Telegraph Company.

The Italian fleet made this demonstration the day the House of Deputies opened its sessions in Constantinople with the newly elected delegates. The address from the Turkish throne on this occasion was: "The unjustifiable war waged by the Italians still continues notwithstanding the earnest desire for peace. We also desire peace, but we cannot make peace except upon the condition that the maintenance of our sovereign rights shall be preserved intact effectively."

The Italian press designated the naval demonstration a protest against the address from the throne, as the tenor of that address was anticipated.

Since sixty steamers with an average of 4000 register tons passed through the Dardanelles daily, neutral trade was badly crippled by closing the Straits of Dardanelles. French and Russian shippers complained to their ambassadors in Constantinople, and demanded damages from the Turkish government for stopping the commerce. The ambassadors and foreign governments, however, delayed action because the Turks declared, on April 19, that the Dardanelles would be open to commerce as soon as there appeared to be no immediate danger of further attacks by the Italians.

The reopening of the Dardanelles was, however, still postponed, because some Italian ships and destroyers continued to operate in the Aegean Sea.

As the Turks had long expected such an attack by the Italians they were fully prepared to resist it, and consequently the Italian attack did not cause any serious damage nor induce a panic among the people.

Speculators attempted to raise the price of provisions, whereupon the authorities in Constantinople published a decree that ample provisions were available in the government depots, and that the supply of provisions in the markets was ample. All persons concerned in efforts to raise the price of provisions would be summarily tried by martial law.

April 16 the representatives of the great powers interrogated the Sublime Porte to ascertain under what conditions Turkey would consider negotiations for peace. The Turkish reply was in substance that which was expressed in the address from the throne to Parliament.

Rear-Admiral Williams having retired from the duty of reorganizing the Turkish fleet, the British Rear-Admiral Limpus, on the active list, was appointed to relieve him, and he arrived at Constantinople about the end of April with his staff of British officers to train the Turkish navy.

The blockade in the Red Sea was extended to about double its former extent, and was declared to embrace the east coast of Arabia on the Red Sea for a distance of 83 nautical miles, from latitude 14° 30′ N. to 15° 50′ N., and included the ports of Hodeida, 2000 inhabitants, Loheija, of 45,000 inhabitants, and Kamaran Island. Neutral ships were allowed five days after the declaration of the blockade during which to leave those ports. Neutral ships engaged in transporting pilgrims to Mecca were allowed to visit the sanitary station on Kamaran Island upon condition that those vessels should pass the southern coasts of that island under the escort of an Italian blockading vessel. The Italians made much of the fact that pilgrimages to Mecca were not interrupted by the Italian blockaders.

After the *Calabria* returned to Italy, the Italians had, after the middle of April, the following naval forces in the Red Sea: The four protected cruisers, *Piemonte*, flagship, *Puglia*, *Liguria*, and *Elba;* the four gunboats, *Aretusa*, *Caprera*, *Volturno* and *Governo*-

olo, the surveying ship *Staffetta* and the four destroyers, *Artigliere, Bersagliere, Granatiere* and *Garibaldino*.

ITALIAN MILITARY OPERATIONS IN AFRICA.

During April the Italian military operations were comparatively quiet. The Turkish-Arabian forces attacked all the coast places occupied by the Italians, but were invariably repulsed without penetrating the Italian lines. A fanatical attack at Mirsa Tobruk was a desperate affair, but badly conducted and disastrously repulsed. Enver Bey claimed a victory at Derni but this was disputed by the Italians whose lines were not penetrated. The Italians did not make any advances into the interior and such an advance did not appear probable soon.

The expedition against Zuara that has been related under the naval operations was the most important of all the Italian operations in Africa in April.

Aeroplanes and balloons made frequent reconnoitering flights, and at times threw bombs upon the enemy with contradictory reported results.

The railroad from Tripoli to Ain Zara was put in operation March 19, and the field railroad to Gargaresch was being built.

The Turkish-Arabian forces in the interior were constantly reinforced, and it is estimated that they had from 15,000 to 20,000 troops before Tripoli. In Cyrenaica the Turks had about 40,000 troops, but they were outnumbered there by the Italians. In Cyrenaica the Arabs were temporarily weakened by the departure of numbers to cultivate their fields in the interior. The Arabs were still enthusiastic for continuing the war, and the reports of their being weary of the war are not well founded.

Twenty-three thousand Italian reservists, of the year 1888, were relieved from active war service in Africa; but there was some delay in getting these reserves home again, and there was consequently some dissatisfaction in regard to these reserves in Italy. New troops were being assembled during April at Naples to replace these reserves in Africa.

In the Red Sea the Arabian insurgent Said Idriss still co-operated with the Italians in the operations against the Turks in that region. Latest reports from Turkish sources claim that Said Idriss had been badly defeated by the Turks, but this lacks confirmation.

NAVAL OPERATIONS.

On April 17 the Italian navy established a rendezvous on the island of Astropalia, which has about 2500 inhabitants, as a base for all the auxiliary vessels of the Italian navy operating in the Aegean Sea. The auxiliaries comprised transports, colliers, distilling ships, tank ships, and ammunition ships. The Italians took possession on April 28, a naval force from the *Pisa* and *Amalfi* of 250 men landing, and capturing the Turkish garrison of seven men. The large open bay on the southern coast of the island was made a temporary naval base, and all the vessels seized by the Italian torpedo boats in the Aegean Sea from Crete to Enos were brought here for action by prize courts.

The exact results of the Italian naval bombardment on April 19, at the Dardanelles, are disputed. It is, however, established that the damage inflicted by the heavy naval guns at 7000 meters on the forts was severe, as the Turkish batteries were frequently hit and the Italians fired more projectiles than the Turks. The Italians may have sustained some slight injury to the rigging of their ships but no serious damage.

But the immediate effect of the Italian naval demonstration was of much greater importance and interest to the commerce of Russia from the Black Sea ports.

The necessity of England's neutrality was emphasized in Parliament because of the vast number of British subjects among the Mahomedans and their interests, and, on the other hand, England's long traditional friendship with Italy.

The British trade was seriously damaged by closing the Dardanelles, but Viscount Morley pointed out that Turkey was justified by the treaties of Paris in 1856, of London in 1871, and Berlin of 1878, to close the Dardanelles as long as the Italian naval forces threatened the security of Constantinople.

April 20 the Russian government protested to the Sublime Porte against closing the Dardanelles by the Turks in violation of the Berlin treaty, and to the great injury of Russian commerce. This act seriously crippled the export trade of the Black Sea that amounts to about $315,000,000 annually, and which sum represents about 43 per cent of the entire export trade of Russia. Shipments of grain, ore, coal and petroleum were stopped. The grain trade was severely affected, the loss caused at Odessa alone is estimated

at 300,000 roubles with a total loss of one and one-half million roubles. This grain was consigned to Italy, southern France, Switzerland, Belgium, England, and western Germany. The delayed exportation of coal was very serious, this trade had only recently been developed on the Don, and was urgently needed because of the coal strikes in England.

At the end of April 20 freight steamers were obliged to wait in the Black Sea ports with four passenger steamers of the Russian Steamship Company, one steamer of the Russian volunteer fleet, and 15 sailing ships. Six passenger steamers and one freight steamer were prevented from entering at this date. During the middle of May there were about 150 steamers laden with grain, coal, ore, naphtha, lumber, etc., laid up in the Russian Black Sea ports waiting for passage through the Dardanelles.

The expense incurred by each of these vessels amounted to between 200 and 400 roubles daily.

The Turkish government replied to the Russian protest that the Dardanelles could not be opened as long as the Italian naval vessels were in the vicinity, but at the beginning of May they yielded to the pressure of the powers, and after long delays finally reopened the Dardanelles on May 19.

Sixty mines had to be removed from the mine fields in the Straits of Dardanelles before it would be safe for vessels to attempt to pass. These mines were removed with great difficulty and required ten working days to clear a channel. One of the mine laying vessels, the tug *Semendar,* was blown up while working with the mines in the Dardanelles. Eight civilian employees and 15 military persons were drowned by this accident.

The passenger steamer *Texas* of the American Archipelago line struck a mine in going out of the harbor of Smyrna, and the explosion of the mine caused the ship to sink so rapidly that only one-half of the people on board were rescued by boats from vessels that immediately went to her assistance.

The Italians then decided to continue pressure upon Turkey by seizing the other islands in the Aegean Sea, especially the island of Rhodes.

This island is about ten miles from the coast of Asia Minor. It had 26,000 inhabitants including 17,000 Greeks. The Turkish garrison consisted of about 1000 infantry and artillery. This

garrison was strengthened by a landwehr force of 10,000 native Mahomedans. Stores of provisions and ammunition magazines were in the interior of the island. Major Abdullah had command of the Turks.

The Italian expeditionary army for the conquest of Rhodes consisted of about 9000 troops, three regiments of infantry, of which two were sent from Benghasi and one from Tobruk; one battalion of chasseurs that had been stationed at Tripoli with several small detachments of light field artillery, cavalry, sanitary detachments and train. The latter including a balloon park and aviation apparatus. Lieutenant-General Ameglio, recently promoted for his distinguished services at Benghasi, was in command of the expeditionary army.

The first and third divisions of the fleet were designated to cooperate with the army expeditionary corps in taking possession of Rhodes. The first division under the command of Vice-Admiral Viale left Tarento, April 30, for Rhodes via the provisional base at Astropalia. A number of transports were assembled at Tobruk with the third division of the fleet and flotillas of torpedo boats to convoy the expeditionary army. The waters in the vicinity of the island of Rhodes were in the meanwhile patrolled by torpedo boats, and a considerable number of Turkish sailing vessels were seized as prizes. On May 1 they cut the cable from Rhodes, Scarpanto, and Candia, so that Rhodes was thereafter without cable communication with the mainland. Turkish reports were transmitted by means of signals, but this method of communication was frequently interrupted, especially at night by the Italian searchlights.

The Italian army convoyed by the third division, under the command of Vice-Admiral Amero, left Tobruk at noon May 2, and arrived off the city of Rhodes during the night of May 4.

While the vessels of the first and third divisions made a demonstration against the city, the transports, accompanied by torpedo boats went to Kalithea Bay, ten miles south of the city, on the east coast of the island. The troops were landed May 4 between 4 a. m., and 2 p. m., without opposition, and at 2 p. m. began to advance upon the city overland from the southward. A light detachment of Turkish troops that had left the city at noon to oppose the invaders were met on Smith Plateau and quickly dispersed,

while at the same time they were exposed to a bombardment by 11 Italian ships.

The Italian troops halted about 2 kilometers from the city at 7 p. m., and passed the night in that position. The Italian warships displayed their searchlights on the city during the entire night. The losses during the skirmishes with the advancing army were very slight. The Italians officially reported seven wounded. During the night the Turkish troops withdrew in small detachments to the west coast of the island via Trianda.

As soon as the troops had landed at Kalithea Bay Vice-Admiral Viale sent an officer to the Wali of Rhodes and demanded a surrender of the island. The Wali declared he could not resist the admiral and had no authority over the Turkish garrison; and he therefore declined under protest. The Admiral again demanded the surrender of the city the next morning with an ultimatum that if not granted within one hour he would proceed to bombard the city. The representative of the Turkish government thereupon yielded, and the Italian army and navy took possession at 10 a. m., May 5.

The Wali of Rhodes—who was also governor of the entire archipelago from Tenedos to Scarpanto was captured on May 7 in the harbor of Lindos by the Italian destroyer *Ostro* as he, with other Turkish officials, was about to leave the island. He and his companions, together with 117 other Turkish prisoners were sent to Tarento May 11.

The Turkish garrison was prevented from escaping from the island by the watchfulness of the Italian torpedo boats, and they rendezvoused in the vicinity of Pithos, a region hemmed in by a mountain range that crosses the island, and at about 18 kilometers southwest of the city.

May 15 General Ameglio took the offensive against the Turks at Psithos. He led troops from two regiments from the northeast and east towards Psithos. Italian troops were landed from the naval vessels at Kalavarda 30 kilometers southwest of Rhodes, and at Malona Bay, 33 kilometers south of Rhodes.

The Turks were thus attacked from three different sides while the battleship *St. Bon* bombarded the only other available road of escape by firing over the hills.

A desperate battle that lasted nine hours was fought by which the Turks were dispersed leaving 83 dead and 26 wounded among the ravines of the hills. The Italians took possession of Psithos and passed the night there. The next morning the Turkish commander surrendered. The Turkish garrison of 983 men, including 33 officers, were prisoners of war. In view of their distinguished bravery the Turkish officers were permitted to retain their swords. The bulk of the Italian forces then returned to the city of Rhodes. The Italians officially reported a total loss during the fight of May 16 as only 4 dead and 26 wounded.

The island of Rhodes was declared to be blockaded with the exception of the port of the city of Rhodes, commerce with which could be maintained under the surveillance of Italian authorities.

The former Italian consul at Salonica, Bivalda, was appointed governor of Rhodes.

In the period from May 8 to May 20 the vessels of the 1st division took possession of the small islands of the Aegean Archipelago between Crete, Rhodes, and Samos. They hoisted the Italian flag over these islands and made prisoners of all Turkish officials and the small Turkish garrisons they found on these islands.

Among others these islands are: Kaltria, Carpantos, Kasos, Episcopi, Nysiros, Kalimnos, Leros, Patmos, Kos, and Smyni. These islands were captured without bloodshed. All officials and military personnel were conveyed as prisoners to Italy.

May 18 the *Regina Margherita* bombarded the small Asia Minor port Marmarice, opposite Rhodes, where Turks had assembled and established a depot.

The continued presence of the Italian warships in the Aegean Sea, and threats published in Italian papers that Italy would take possession of other larger islands, induced the Turkish government to reinforce those islands and complete their defences. All persons who could not participate in the defence of these islands were removed to the mainland, and additional troops were sent to reinforce the garrisons. Mytilene which had a garrison of 3000 received a reinforcement of 2000 troops who were conveyed thither in small detachments by small boats from Aivali. The garrison of Chios was in like manner reinforced by several thousand troops.

The ports in Syria: Beirut, Mersina, Acre, Jaffe and Haida were reinforced and fortified.

May 20 the Turkish government decreed the banishment of all Italians from Turkish dominions; about 50,000 persons, 12,000 of whom were in Constantinople. The decree excepted clericals, widows, cripples and laborers (about 2000 men), and required all others to leave within 14 days.

The decree of banishment was handed to the German ambassador, representing the Italian government in Constantinople, on May 22. This decree was based upon the manner in which the Italians conducted the war, and especially protested against the Italians for taking Turkish civilian officials as prisoners of war to Italy. It also based its necessity upon the fear of an outbreak by the populace which was much embittered against the Italians for the war and the government was not able to protect Italians residing in Turkey.

A number of Italian ship captains were arrested, as they might serve as pilots for the Italian navy.

The English and French press published protests against the Italian seizure of these 11 islands in the Grecian Archipelago, and claimed that this act materially changed the map of Europe and strengthened the Triple Alliance in the balance of power among the European states. Russia, France and England were weakened by these acquisitions by Italy, and control of the great commercial route through the Mediterranean was passing to Italy and the Triple Alliance.

The press demanded that efforts should be made to stop the war and further encroachments by Italy.

The Italians proceeded to make their possession of these islands secure and permanent. A fortnightly mail service was established from Brindisi via Patras, Pireaus, and Astropalia to Rhodes. The Italian Chamber at the same time established mail steamer service between Italy and North African ports as follows:

Syracuse to Tripoli, three times every week.

Syracuse to Benghasi, twice a week.

Palermo, Trapani, Tripoli, once a week.

Genoa, Sicilian ports and North African ports, once a week, and Venice and North African ports, once a week.

Telegraphic communication was reestablished by radio stations and cables as previously mentioned.

There was no activity of any importance by the navy on the north coast of Tripoli and Cyrenaica during May. The schoolship division and a few ships of the navy cruised on the coast, but on May 25 the schoolship division left Zuara, or rather the new base Sidi-Said, to recruit in Italian home ports.

April 28 the Italian transport *Domenico* with 1275 reservists en route home was stranded on Cape Spartivento, but torpedo boats and other vessels rescued the transport.

ITALIAN MILITARY CAMPAIGN IN TRIPOLI AND CYRENAICA.

During the period from April 15 to May 15, 1912, there were engagements at all the places occupied by the Italians on the coast of Africa, but the Italians held their positions throughout without making any advances in the conquest of the country. The summer opened with intense heat and violent sandstorms. An advance into the interior was not contemplated for this season.

The expeditionary corps that landed at Sidi-Said secured their position on the line to Fort Forwa, also known as Bu Kamesh. The occupation of Sidi-Said temporarily stopped the contraband trade, and the torpedo-boat harbor was completed. A radio telegraph station was erected and regular communication was established with Tripoli by means of dirigible balloons.

The constantly increasing Turkish-Arabian forces, which were well supplied with artillery, opposed the Italians all along the coast. Major Fethi Bey, formerly Turkish military attaché at Paris, was in supreme command of the Turkish-Arabian forces. There were many desperate attacks by the Turks which were invariably repulsed, but often with great difficulty.

During the latter part of April the Italians made several advances to the southwestward but were compelled to return, and even lost territory they had previously held.

Zuara was still held by the Turks, but the caravan trade was considerably reduced via the Tunisian frontier.

At Tripoli sandstorms caused considerable damage. One aeroplane was destroyed and all the others were damaged, and the Italians barely held their positions. The defences at Tadjura, east of Tripoli, were strengthened.

May 2 the Italians at Homs surprised the Turks and captured the heights southeast of Lebda. The Italians lost four officers and

61 men killed and wounded in this affair, but they repulsed the Turks and have managed to retain this advantageous position which was strongly fortified.

The spirit of the Turkish-Arabian troops was enthusiastic for the war. There were between 300 and 400 trained Turkish officers in the field. They had ample supplies of ammunition and they were not hampered for commissariat. The prospects of the crops were good this year.

(TO BE CONTINUED.)

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON THE DEPARTMENT'S PROPOSED PERSONNEL BILL.

By Captain H. O. Dunn, U. S. Navy.

The Department's proposed Personnel Bill is a pressing subject which the service should take up seriously and impartially.

The attitude taken by some officers "let well enough alone," assuming the present status is satisfactory, is not well founded. The writer, who has been in touch for some time with the sentiment in Congress, can assure the service that that body does not intend to let the present conditions continue. Economy is the watchword, and it does not require a vivid imagination to see that the present scheme of organization is not economical, nor does it require much thought to foresee where the pruning will take place. The fallacies of "vested interests" and "implied contracts" can be preached *ad infinitum*, but the bald fact remains that our existence depends upon the will of Congress. If the service will study the tables so carefully prepared by the Department entitled "Data as to the Comparative Annual Cost of the Commissioned Personnel of the U. S. Navy and Marine Corps," the economy of the new bill will become apparent.

It is needless to point out the coming "hump" in the junior grade lieutenant's list under the present law. It will not be many years before they will be 40 years old and waiting for promotion.

The question, will the new bill increase the efficiency of the service, should be answered by each officer fairly and honestly, ignoring the attitude "how will it affect me?" and to answer this question it is necessary to read the bill. The Department has sent to each and every officer concerned a copy of the bill together with all the hearings and literature on the subject, so the basis for an opinion is in the hands of the service. It is up to the service to give an intelligent answer, and not a snap judgment.

It is difficult to detach one's personal interest in such a matter and to take the broad ground of the good of the service. There is no doubt that the present status could not be very much improved from a *personal* point of view, where nearly every one who enters has a good chance to be promoted to each grade and retire on the highest pay in flag rank, providing he keeps his digestion and does not strike his superior officer.

If the Pennsylvania Railroad should announce that hereafter all officials from ticket agents up, would be promoted by seniority and all retired into the grade of general manager, no doubt it would please the personnel, but the efficiency of the road would not improve.

Any military service that does not take into account competition will not succeed, or at least attain the degree of success necessary to win battles. Our success in gunnery has been due to competition—let us apply it to the personnel. It is time to recognize the fact that the navy does not exist for the individual, its function is to win battles. The complaint is sometimes made that the bill is too long and complicated. The revised bill has been considerably shortened and simplified, and, considering the large and important field that it covers, it does not seem unduly long. If the average officer would take time to read it carefully the complications would disappear.

Amalgamation is the stumbling block which many officers cannot surmount. A board of experienced officers representing the corps in question went into this subject very thoroughly and decided not only it could be done but also how it could be accomplished. [See Report of Amalgamation Board, December 20, 1911, a copy of which was sent to all officers.]

From a careful study of the subject the difficulties disappear. Surely the successful effort in amalgamating the engineers some years ago points to success. The objection, that officers at present have too many different subjects to master, and to add construction and pay duties would overwhelm them, is entirely unfounded and arises from insufficient knowledge of the plan proposed. It is not the intention of making *all* officers take up *all* specialties. No officer will be *required* to take up any specialty except that of a naval officer. Most of them will of their own accord take up some one specialty. Line officers at present specialize in ordnance, ammunition, electricity, engineering, wireless, submarine, mines,

and torpedoes, and have made notable successes in each. It is proposed to add two more. It should be remembered that the constructors are all graduates of the Naval Academy, and before entering the corps they have about two years sea duty as ensigns. The great gain in amalgamation is flexibility. All hands on board except the doctor and chaplain will be line officers. All will be working for the navy and not for any separate corps. Team work is what wins battles.

Ultimately all line officers will not be constructors or pay officers, but all constructors and pay officers will be sea-going line officers.

The present curriculum of the Naval Academy insures the turning out of good average ensigns—the post graduate courses, recently established, are a fitting corollary to the new personnel bill and can carry out its every measure.

NAVY DEPARTMENT'S PROPOSED BILL TO REGULATE AND INCREASE THE EFFICIENCY OF THE PERSONNEL OF THE UNITED STATES NAVY AND MARINE CORPS.*

(Revised to Date, November 12, 1912.)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after the passage of this act the numbers of the personnel of the United States Navy on the active list shall be based on the total displacement tonnage, as contained in the official annual Navy Register, of the battleships and cruisers of the Navy that have been authorized by law within twenty-five years; and the personnel for any fiscal year shall be based on such total tonnage existing on January first next preceding said fiscal year: *Provided,* That hereafter the annual estimates for the naval establishment shall contain a list of the battleships and cruisers of the Navy as herein defined, with the displacement tonnage and date of authorization of each of them, together with the total of such tonnage; also a list of the numbers of the enlisted personnel and officers of the Navy and Marine Corps at full strength based on such total tonnage; and until such full strength shall be reached said list shall contain the corresponding estimated numbers for the year

*Discussions by officers of this bill are desired by the Navy Department, and should be submitted direct to the Department.

in question under the operation of this act, said estimated numbers in no case to exceed the full numbers based on the tonnage; and the numbers as enacted into law shall be the authorized numbers for the next ensuing fiscal year.

SEC. 2. That the full strength of the enlisted personnel of the Navy on the active list shall be fixed hereafter on July first of each year at seventy men for every one thousand tons, and fractions in proportion, of the battleships and cruisers of the Navy as ascertained in section one preceding. The authorized numbers for any fiscal year shall be distributed in such ratings as the Secretary of the Navy shall determine, with the approval of the President: *Provided,* That the authorized numbers of such personnel for the fiscal year ending June thirtieth, nineteen hundred and fourteen, shall be fifty-two thousand five hundred.

SEC. 3. That the full strength of the commissioned line officers of the Navy on the active list, excluding officers borne on the Navy list as additional numbers and excluding commissioned warrant officers, shall be fixed hereafter on July first of each year at three such officers for every one thousand tons, and fractions in proportion, of the battleships and cruisers of the Navy as ascertained in section one of this act: *Provided,* That the total authorized number of such commissioned officers shall not hereby be increased more than ten per centum nor decreased more than five per centum in any fiscal year.

SEC. 4. That the total resulting strength of the commissioned line officers of the Navy on the active list on the passage of this act shall be distributed in the several grades in the proportion of one flag officer, four captains, five commanders, thirteen lieutenant commanders, and fifty-five lieutenants, lieutenants (junior grade), and ensigns; and the same proportional distribution shall be followed hereafter in the data for the annual estimates required by section one of this act: *Provided,* That the resulting strength of any of said grades on the passage of this act, and before such proportional distribution, shall not hereby be reduced: *Provided further,* That the authorized strength of the several grades of the line on the active list, exclusive of the Admiral of the Navy, and exclusive of additional numbers, on the passage of this act and for the fiscal year ending June thirtieth, nineteen hundred and fourteen, shall not exceed one admiral, five vice admirals, and twenty rear admirals, one hundred captains, one hundred and thirty-five

commanders, three hundred and fifty lieutenant commanders, and such total number of lieutenants, lieutenants (junior grade), and ensigns as may qualify for said grades under existing law and the provisions of this act.

SEC. 5. That the total number of flag officers, as determined by the provisions of section four preceding shall be distributed in grades in the proportion of one admiral, three vice admirals, and twelve rear admirals. Rear admirals in the upper half of said grade shall receive the pay and allowances now prescribed by law for rear admirals, first nine; and rear admirals in the lower half of said grade shall receive the pay and allowances now prescribed by law for rear admirals, second nine. The President shall appoint the vice admirals, by and with the advice and consent of the Senate, from rear admirals on the active list who have or shall have served creditably as such in command of a fleet, squadron, or division. Similarly, he shall appoint the admirals, by and with the advice and consent of the Senate, from vice admirals on the active list who shall have served creditably as such in command of a fleet, squadron, or division.

SEC. 6. That the annual pay of admirals shall be thirteen thousand five hundred dollars, of vice admirals eleven thousand dollars. The Admiral of the Navy shall be entitled to quarters of twelve rooms, admirals eleven rooms, and vice admirals ten rooms, or in each case commutation therefor at the rate of twelve dollars per room per month, the heat and light allowance to correspond to the allowance of quarters. Admirals and vice admirals shall, on reaching the age of sixty-five years, be retired with three-fourths the pay of their grade. Admirals and vice admirals availing themselves of the privilege of voluntary retirement pursuant to law shall receive the retirement pay of the next lower grade only.

SEC. 7. That after June thirtieth, nineteen hundred and thirteen, there shall be allowed at the Naval Academy one midshipman for each Senator, Representative, and Delegate in Congress, one for Porto Rico, and one for the District of Columbia, and forty at large. The time of admitting successors to the midshipmen at the Naval Academy shall be such as may be established by law from time to time with the object of maintaining the personnel of officers at full strength as provided in this act, and the annual estimates shall recommend, when necessary, such

time as may be suitable: *Provided,* That after June thirtieth, nineteen hundred and thirteen, successors to midshipmen shall be admitted when said midshipmen shall have served two years at the Naval Academy, or, in case of a vacancy in either of said years, then with the next entering class.

SEC. 8. That hereafter midshipmen shall be between the ages of fifteen years and eighteen years on July first of the calendar year of entry. In putting into effect the new ages of entry, the change from the present age limit shall be made as follows: For the current calendar year there shall be no change; subsequently the limits for the first year thereafter shall be fifteen years and nineteen years, and for the second and subsequent years, fifteen years and eighteen years, as required by this act.

SEC. 9. That midshipmen on graduation may be assigned by the Secretary of the Navy to fill vacancies in the lowest commissioned grades of the Corps of Civil Engineers and the Marine Corps: *Provided,* That ensigns may, with the approval of the Secretary of the Navy, be so assigned to said corps on their own application. Graduate midshipmen and ensigns hereafter assigned to the Corps of Civil Engineers shall take rank and precedence in said corps in accordance with the official order of precedence of officers, which order shall not be changed. Graduate midshipmen hereafter assigned to the Marine Corps shall take rank in said corps in accordance with the date of their commission therein, and ensigns hereafter assigned to the Marine Corps shall take rank in said corps, in accordance with the date of commission as ensign of officers of the line of the Navy of the same precedence as said ensigns.

SEC. 10. That ensigns shall serve three years after the completion of the four years' course at the Naval Academy and shall thereafter be promoted in the order of seniority subject to the examination required by law, to the next higher grade after seven years' total service, counting from July first of the calendar year of precedence date. Thereafter officers below flag rank may be promoted at any time, in the order of seniority, to fill a vacancy in the next higher grade; and shall be promoted in such order subject to the examination required by law, after completing periods of total service, counting from July first of the calendar year of precedence date, as herewith enumerated: Lieutenants (junior grade), ten years; lieutenants, eighteen years; lieutenant

commanders, twenty-four years; commanders, twenty-nine years; captains, thirty-seven years: *Provided*, That such promotions shall not cause at the time an excess in the grade of rear admiral of more than fifteen per centum of the authorized number of rear admirals, nor in the grades of captain, commander, and lieutenant commander for the first ten years after the passage of this act, an excess at the time of more than ten per centum of the authorized numbers of said respective grades; nor after ten years an excess at the time of more than fifteen per centum in any of said grades; and said excess in any grade shall be reduced immediately by retirements from the whole grade, as provided in sections twelve and thirteen of this act.

SEC. 11. That the promotions of officers for total length of service, as required by section 10 preceding, shall begin on July first following the passage of this act, and shall continue on the first day of each fiscal year thereafter.

SEC. 12. That when in June of any year there is a prospect that on the ensuing July first there will be a greater number of captains of thirty-seven or more years' total service, counting from July first of the calendar year of precedence date, than will be required to fill the authorized number of flag officers, the Secretary of the Navy shall convene a board of five of the highest ranking available flag officers, and shall place at its disposal the service and medical records on file in the Navy Department of rear admirals and of captains due by such length of service for promotion to the grade of rear admiral. Said board shall then, as soon as practicable on or after said July first, after the promotions and voluntary retirements due on that date shall have been made, select for retirement a sufficient number of rear admirals to reduce the total number of flag officers on said July first to the authorized number of flag officers. Each member of said board shall swear, or affirm, that he will, without prejudice or partiality, and having in view solely the special fitness of officers and the efficiency of the naval service, perform the duties imposed upon him by this act. The finding of the board, which shall be in writing, signed by all the members, not less than four governing and no member to vote on the name of any officer his senior, shall be transmitted to the President, who shall thereupon, by order, make the transfers of such officers to the retired list as are selected by said board; and said retirements shall date as of July first. The redivision of the

rear admirals into upper and lower half shall not take place until said retirements shall have been made. Rear admirals so retired shall receive three-fourths the pay of their grade.

SEC. 13. That when in June of any year there is a prospect that the numbers of captains, commanders, or lieutenant commanders, that will result after the ensuing July first promotions will exceed the authorized numbers of their respective grades, the Secretary of the Navy shall convene a board of five rear admirals, and shall place at its disposal the service and medical records on file in the Navy Department of all the officers in the grades of captain, commander, and lieutenant commander, or due by length of service for promotion to the grade of lieutenant commander. Said board shall then, as soon as practicable on or after said July first, select for retirement a sufficient number of said officers in each grade as it will exist on said July first, after the promotions and voluntary retirements due on that date shall have been made, to reduce the total number of captains, commanders, and lieutenant commanders, on said July first to the authorized numbers of said respective grades. The same procedure in regard to oaths (or affirmation) shall be followed as prescribed in section twelve of this act. The finding of said board, which shall be in writing, signed by all the members, not less than four governing, shall be transmitted to the President, who shall thereupon, by order, make the transfers of such officers to the retired list as are selected by said board; and said retirements shall date as of July first; *Provided*, That officers so retired shall be entitled to a graded rate of pay in accordance with their rank and length of service, as established in section twenty-three of this act for officers retiring voluntarily on their own application, such retirement pay in any case to be not less than the lowest pay there provided for an officer of the same rank of eighteen years' service: *Provided further*, That should the medical record of any officer so retired show evidence of incapacity incident to the service, or physical disability incurred in the line of duty, he shall, if said incapacity or disability be confirmed by a retiring board, and if the recommendation of said board be approved by the President, be retired in accordance with the provisions of sections fourteen hundred and fifty-three and fifteen hundred and eighty-eight, Revised Statutes.

SEC. 14. That the officers constituting the Pay Corps and the Construction Corps of the United States Navy be, and are hereby, transferred to the line of the Navy, and shall be commissioned accordingly.

SEC. 15. That said transfer to the line shall be made in the official order of precedence of officers at date of passage of this act, with rank according to such precedence in the line, or, in case loss of grade, or loss of rank in grade, would result, then to the grade in the line corresponding to such grade, or rank in grade, previous to said transfer, but in any case without change in the official order of precedence; *Provided,* That officers of said corps transferred to the line shall continue to rank with other officers of like grade or rank in the line or in any staff corps in accordance with the official order of precedence, in the same manner as before such transfer: *Provided, however,* That should any officer so transferred to the line have lost precedence on original appointment to the corps from which transferred, he shall, in future, while retaining his grade and present precedence, be entitled to the rank, pay, and allowances of line officers of his original precedence.

SEC. 16. That any officer of the former Pay Corps or the former Construction Corps, after such transfer to the line, may, upon his own application at any time thereafter, be assigned temporarily to the general duties of the line, and if so assigned shall be given a reasonable opportunity to acquire the necessary experience in such line of duties up to and including the duties of the grade he then holds, at the conclusion of which he shall be permanently available for such assignment if he pass the examination provided by law as preliminary to promotion to such grade, failure to pass not to displace such officer from the status for duty occupied by him prior to such temporary assignment: *Provided,* That should any officer so transferred to the line, and who shall have subsequently qualified for the general duties of the line, have lost precedence on original appointment to the corps from which transferred, he shall, after such qualification, resume his former order of precedence, with its corresponding grade and rank, subject to the examination required by law in case of a promotion to a higher grade.

SEC. 17. That officers of the Pay Corps and the Construction Corps transferred to the line in accordance with this act, who

shall not qualify for the general duties of the line in accordance with the preceding section, shall preserve their present status for duty, and shall have all necessary authority over officers and enlisted men for performing said duty: *Provided*, That assistant naval constructors of the rank of lieutenant (junior grade) so transferred shall be available for the general duties of the line.

SEC. 18. That so far as may be consistent with the efficiency of the service the number of selections for retirement, under the requirements of sections twelve and thirteen of this act, from officers of the former Pay Corps and the former construction corps who shall not have qualified for the general duties of the line shall be in any grade in proportion to the number of such officers in that grade.

SEC. 19. That after the passage of this act the duties now performed by officers of the Pay Corps and the Construction Corps of the Navy shall be performed by officers of the line who may be detailed for such duties: *Provided*, That no such detail be made of any officer of the present line who may be above the rank of lieutenant at the date of passage of this act, except temporarily in cases of emergency: *Provided further*, That sections thirteen hundred and eighty-three, thirteen hundred and eighty-four, and thirteen hundred and eighty-five of the Revised Statutes be, and are hereby, repealed.

SEC. 20. That the Chief of the Bureau of Construction and Repair and the Chief of the Bureau of Supplies and Accounts shall be appointed from the list of line officers of the Navy not below the grade of commander, or, in case of officers of the former Construction Corps or the former Pay Corps, not below the grade of lieutenant commander, and who shall be skilled in the duties under cognizance of said respective bureaus.

SEC. 21. That temporarily and until the total length of service of the senior captains shall have been first reduced below thirty-seven years, counting from July first of the calendar year of precedence date, captains of more than thirty-seven years' service, and due by such service for promotion to the grade of rear admiral, if retired on the recommendation of the board as provided in section thirteen of this act, shall be retired with the rank and three-fourths the pay of rear admirals of the lower half; and likewise said captains shall at any time during said temporary restriction, in the discretion and upon the approval of the President,

have the privilege of voluntary retirement on their own application in the same manner as if they had been retired on the recommendation of said board.

SEC. 22. That officers of the Navy of the rank of lieutenant commander and above, in the line or in any staff corps, or officers of the Marine Corps of the rank of captain and above, who may be borne on the list of the Navy and Marine Corps as additional numbers, shall, whenever the best interests of the service require, be subject to retirement on the recommendation of the boards provided in this act, in addition to the numbers recommended in accordance with the requirements thereof; but the average yearly proportion of such retirements shall not exceed the average yearly proportion of retirements of other officers of the same rank and grade who shall be retired on the recommendation of said boards; and said officers shall be retired in all respects in the same manner as other officers of the same rank and grade as provided in this act.

SEC. 23. That when the interest of the service shall permit it, and in the discretion and upon the approval of the President, an officer of the Navy or Marine Corps of more than eighteen years' total service, including service in the Regular or Volunteer Army, Navy, or Marine Corps, may, upon his own application, be retired at a graded rate of pay based on rank and length of service. Such graded pay shall be, for each completed year of such service, a percentage of his pay at date of retirement, as herewith enumerated: Eighteen years, thirty-three per centum; nineteen years, thirty-six per centum; twenty years, thirty-nine per centum; twenty-one years, forty-two per centum; twenty-two years, forty-five per centum; twenty-three years, forty-eight per centum; twenty-four years, fifty-one per centum; twenty-five years, fifty-four per centum; twenty-six years, fifty-eight per centum; twenty-seven years, sixty-two per centum; twenty-eight years, sixty-six per centum; twenty-nine years, seventy per centum; thirty or more years, seventy-five per centum: *Provided*, That in determining the service necessary for retirement and the retirement pay, under this section, of officers who have heretofore been appointed or commissioned in the Navy from civil life the credit of five years' service, as prescribed by the act of March third, eighteen hundred and ninety-nine, to reorganize and increase the efficiency of the personnel of the Navy and Marine Corps of the United

States, shall be duly counted in determining the total service of said officers for the purposes of this section; and in determining the service necessary for retirement and the retirement pay, under this section, of officers of the Navy hereafter to be commissioned, and of officers of the Marine Corps heretofore commissioned from civil life or from the ranks, or of officers of said corps hereafter to be commissioned, the total service of said officers shall be determined as in sections twenty-seven and twenty-eight, respectively, of this act: *And provided further* that so much of the act of June 10, 1896, under pay of the Navy reading "and provided further that hereafter no payment shall be made from appropriations made by Congress to any officer of the Navy or Marine Corps on the active or retired list while such officer is employed after June 30, 1897, by any person or company furnishing naval supplies or war material to the Government: and such payment is hereby made unlawful after such date" is hereby repealed.

SEC. 24. That section fourteen hundred and eighty-one, Revised Statutes, be, and the same hereby is, amended to read:

"SEC. 1481. Staff officers of the Navy or Marine Corps who shall have served faithfully for forty-five years, shall, when retired, have the rank of commodore or brigadier general: and any of said officers who shall be retired at the age of sixty-two years or sixty-four years, before having served for forty-five years, but who shall have served faithfully until retired, shall, on the completion of forty years from their entry into the service, have the rank of commodore or brigadier general: *Provided*, That said staff officers may, for the purposes of this section, count their service from their date of precedence, or in the case of marine officers, may include such credit of service for retirement as is authorized by law: *And provided further*, That nothing in this section shall operate to create any claim for back pay or allowances."

SEC. 25. That hereafter officers of the Navy or Marine Corps before being promoted to the next higher rank, shall be examined for promotion under such rules as shall be prescribed by the President. Any such officer who may be ordered before an examination board, or a retiring board, and in the opinion of said board is not qualified for promotion by reason of professional or mental unfitness, or by reason of incapacity not incident to the service, may, subject to the restriction in the case of officers below the

rank of commander or lieutenant colonel of section fifteen hundred and five, Revised Statutes, as herein amended, on the recommendation of said board, if approved by the President, be retired in his rank at a rate of pay in accordance with his record and length of service, such rate of pay to be stated in the recommendation, but in no case to exceed the graded rate of pay based on rank and length of service as provided in section twenty-three of this act for officers who may retire voluntarily on their own application; or he may be retired on furlough pay, or wholly retired with one year's pay, according to the provisions of section fourteen hundred and fifty-four, Revised Statutes: *Provided,* That if unfit to perform the duties of the place to which it is proposed to promote him, by reason of drunkenness, persistent failure to pay debts, or from any other cause arising from his own misconduct, he shall, in accordance with the provisions of the act of August fifth, eighteen hundred and eighty-two, as hereby amended, be discharged with not more than one year's pay; and this provision shall apply to, and is hereby extended to include, officers of the Marine Corps: *Provided further,* That section fifteen hundred and five, Revised Statutes, be, and hereby is, amended to read:

"SEC. 1505. Any officer of the Navy or Marine Corps on the active list below the rank of commander or lieutenant colonel, who, upon original examination is found not professionally qualified, shall be suspended from promotion for a period of six months from the date of approval of said examination, and shall suffer a loss of numbers equal to the average six months' rate of promotion to the grade for which said officer is undergoing examination during the five fiscal years next preceding the date of the approval of said examination, and upon the termination of said suspension from promotion he shall be reexamined, and in case of his failure upon such reexamination he shall be dropped from the service with not more than one year's pay, unless otherwise recommended by the examining board pursuant to law."

SEC. 26. That sections eight and nine of the act of March third, eighteen hundred and ninety-nine, to reorganize and increase the efficiency of the personnel of the Navy and Marine Corps of the United States (personnel act), be, and hereby are, repealed from the date of passage of this act.

SEC. 27. That the precedence service and service for computation of pay of all officers of the Navy hereafter commissioned

in their first commission shall be the same as that of graduates of the Naval Academy reaching at the same time the same rank as that of said first commission: *Provided,* That the precedence service and service for computation of pay of commissioned warrant officers and warrant officers shall not hereby be reduced, now or hereafter: *And provided further,* That nothing in this section shall be so construed as to change in any way the precedence service or service for computation of pay of any officer in the naval service at the date of passage of this act.

SEC. 28. That the service for computation of pay of all officers of the Marine Corps hereafter commissioned in their first commission shall be the same as that of graduates of the Naval Academy reaching at the same time the same rank as that of said first commission: *Provided,* That the service for computation of pay of officers of the Marine Corps heretofore commissioned from civil life or from the ranks shall be considered to have been four years at date of first commission: *Provided, however,* That the service of any such officer shall not hereby be reduced: *And provided further,* That no back pay shall hereby accrue.

SEC. 29. That nothing in this act shall be so construed as to reduce the rank or grade of any commissioned, warrant, or appointed officer now on the active or retired list of the Navy or Marine Corps; nor to reduce the pay or allowances now authorized by law for any commissioned, warrant, or appointed officer remaining on the active list of the Navy or Marine Corps; nor to increase or reduce the pay or allowances of any commissioned, warrant, or appointed officer now on the retired list of the Navy or Marine Corps.

SEC. 30. That the full strength of the Medical Corps of the United States Navy on the active list, exclusive of the Dental Corps, shall be fixed hereafter on July first of each year at one officer of said corps for each two thousand tons, and fractions in proportion of the battleships and cruisers of the Navy as ascertained in section one of this act: *Provided,* That the present authorized strength of the Medical Corps shall not hereby be reduced: *Provided further,* That the total authorized strength of said corps shall not hereby be increased more than ten per centum nor decreased more than five per centum in any fiscal year: *And provided further,* That the authorized strength of the Medical Corps on the active list, exclusive of the Dental Corps, for the fiscal

year ending June thirtieth, nineteen hundred and fourteen, shall be three hundred and forty-five.

SEC. 31. That on the passage of this act the active list of the Medical Corps shall be arranged in the several grades of medical director with the rank of captain, medical inspector with the rank of commander, surgeon with the rank of lieutenant commander, passed assistant surgeon with the rank of lieutenant, and assistant surgeon with the rank of lieutenant (junior grade), in such manner that officers of said corps shall have the same rank, so far as authorized for the Medical Corps, and as specified in this section, as line officers of the same precedence; and thereafter officers of the Medical Corps shall be promoted to the next higher of said grades when the line officer with whom or next after whom they take precedence is promoted to the corresponding grade in the line.

SEC. 32. That no person shall be appointed assistant surgeon in the Navy until he shall have been examined and found qualified by a board of medical officers, designated by the Secretary of the Navy, and under such rules as the Secretary of the Navy shall prescribe, nor who is at the time of such appointment less than twenty-two or more than thirty years of age; and assistant surgeons commissioned on the same date shall take rank in their order of merit as determined at the date of examination for said appointment.

SEC. 33. That when in June of any year there is a prospect that the numbers resulting in the several grades of the Medical Corps after the ensuing July first promotions in accordance with the provisions of sections ten and thirty-one of this act will exceed in the grade of medical director five sixty-fifths, in the grade of medical inspector five sixty-fifths, or in the grade of surgeon thirteen sixty-fifths of the full strength of the Medical Corps, excluding the Dental Corps, the Secretary of the Navy shall convene a board composed of two flag officers and the three highest ranking available medical directors, and shall place at its disposal the service and medical records on file in the Navy Department of all the officers in the grades of medical director, medical inspector, and surgeon, or due by length of service for promotion to the grade of surgeon. Said board shall then, as soon as practicable on or after said July first, select for retirement, no member to vote on the name of any officer his senior, a sufficient number

of said officers in each grade as it will exist on said July first, after the promotions and voluntary retirements due on that date shall have been made, to reduce the total number of medical directors, medical inspectors, and surgeons on said July first to five sixty-fifths, five sixty-fifths, and thirteen sixty-fifths, respectively, of the full strength of the Medical Corps, excluding the Dental Corps. The same procedure in regard to oaths (or affirmation) shall be followed as prescribed in section twelve of this act, and the finding and action thereon shall be in accordance with the requirements and subject to the provisos of section thirteen of this act: *Provided*, That the number of transfers of such officers to the retired list from any of said grades on July first of any year shall not exceed ten per centum of the actual number in such grade at the time of said transfer.

SEC. 34. That the pay and allowances of officers of the Medical Reserve Corps of the Navy on active duty shall be the same as are now or may hereafter be provided by law for the Medical Reserve Corps of the Army: *Provided further*, That officers of the Medical Reserve Corps who shall apply for appointment in the Medical Corps of the Navy may, upon the recommendation of the Surgeon General, be placed on active duty by the Secretary of the Navy for instruction and further examination to determine their fitness for commission in the Medical Corps.

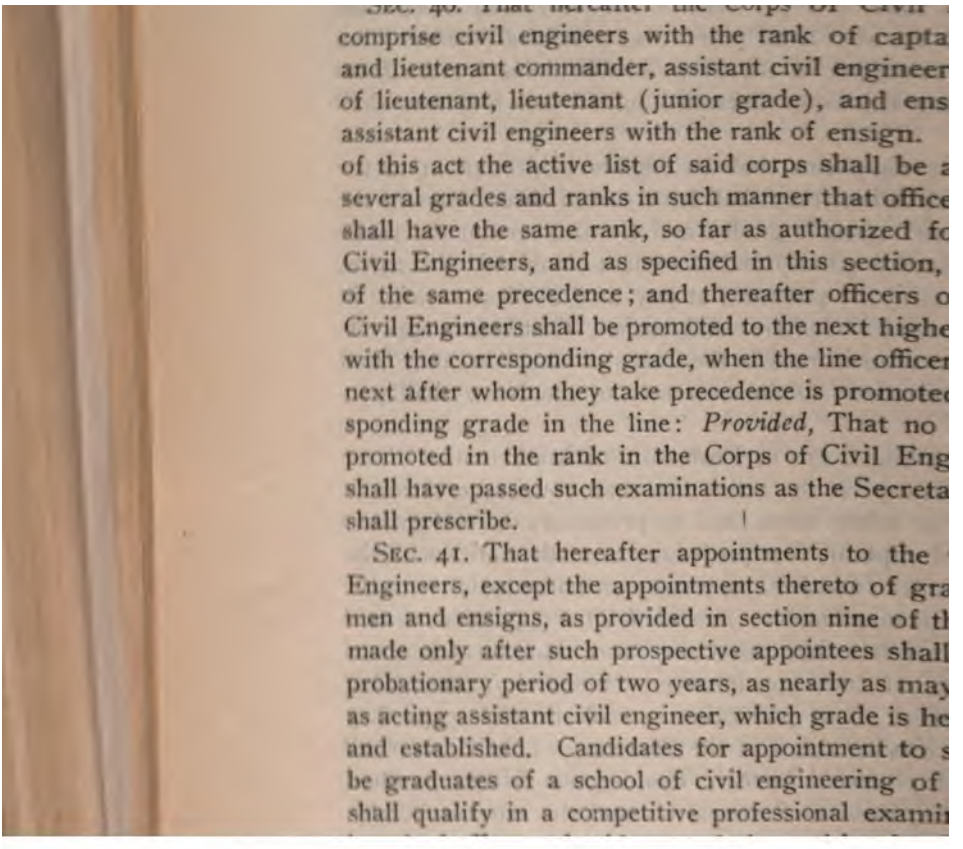
SEC. 35. That the Hospital Corps of the United States Navy shall consist of chief pharmacists, pharmacists, and enlisted men classed as chief hospital stewards, hospital stewards first class, hospital stewards second class, hospital stewards third class, and hospital apprentices, corresponding, respectively, to the enlisted ratings of chief petty officer, petty officer first class, petty officer second class, and petty officer third class, and ordinary seaman; that pharmacists shall be appointed by the President, and that vacancies in the grade of pharmacist shall be filled, by selection, from the enlisted force of the Hospital Corps of the United States Navy, subject to such examination as the Secretary of the Navy shall prescribe; that the pay, allowances, and emoluments of the enlisted men of the Hospital Corps shall be the same as are now or may hereafter be allowed by law for respective corresponding ratings in the seaman branch: *Provided*, That the pay of the rating of chief hospital steward shall not be reduced below that allowed by existing law for hospital steward.

SEC. 36. That the full strength of the Corps of Chaplains of the United States Navy on the active list shall be fixed hereafter on July first of each year at one officer of said corps for each twenty thousand tons, and fractions in proportion, of the battleships and cruisers of the Navy as ascertained in section one of this act: *Provided*, That the present authorized strength of the Corps of Chaplains shall not hereby be reduced: *Provided further*, That the total authorized strength of said corps shall not hereby be increased more than ten per centum nor decreased more than five per centum in any fiscal year: *And provided further*, That the authorized strength of the Corps of Chaplains for the fiscal year ending June thirtieth, nineteen hundred and fourteen, shall be twenty-six.

SEC. 37. That chaplains shall be eligible to promotion to the next higher rank when they shall have served three years in the rank of lieutenant (junior grade) and eleven years in the ranks of lieutenant (junior grade) and lieutenant combined: *Provided*, That chaplains may be promoted at any time to fill a vacancy in the next higher rank: *And provided further*, That before appointment to or promotion in rank in the Corps of Chaplains they shall pass such examinations as the Secretary of the Navy shall prescribe.

SEC. 38. That the Corps of Professors of Mathematics of the United States Navy on the active list shall consist hereafter of twelve officers, of whom three shall be professors of mathematics with the rank of captain; four professors of mathematics with the rank of commander; and five, professors of mathematics with the rank of lieutenant commander: *Provided*, That appointees to said corps shall be not less than thirty nor more than forty years of age at the time of such appointment: *Provided further*, That before appointment to or promotion in rank in said corps they shall pass such examinations as the Secretary of the Navy shall prescribe: *And provided further*, That section fifteen hundred and twenty-eight, Revised Statutes, be, and the same is hereby, repealed.

SEC. 39. That the full strength of the Corps of Civil Engineers of the United States Navy on the active list shall be fixed hereafter on July first of each year at one officer of said corps for each twenty thousand tons, and fractions in proportion, of the battleships and cruisers of the Navy as ascertained in section one of this



SEC. 40. That hereafter the Corps of Civil
comprise civil engineers with the rank of capta
and lieutenant commander, assistant civil engineer
of lieutenant, lieutenant (junior grade), and ens
assistant civil engineers with the rank of ensign.
of this act the active list of said corps shall be a
several grades and ranks in such manner that office
shall have the same rank, so far as authorized fo
Civil Engineers, and as specified in this section,
of the same precedence; and thereafter officers o
Civil Engineers shall be promoted to the next highe
with the corresponding grade, when the line officer
next after whom they take precedence is promoted
sponding grade in the line: *Provided*, That no
promoted in the rank in the Corps of Civil Eng
shall have passed such examinations as the Secreta
shall prescribe.

SEC. 41. That hereafter appointments to the
Engineers, except the appointments thereto of gra
men and ensigns, as provided in section nine of th
made only after such prospective appointees shall
probationary period of two years, as nearly as may
as acting assistant civil engineer, which grade is he
and established. Candidates for appointment to s
be graduates of a school of civil engineering of
shall qualify in a competitive professional exami

to the Corps of Civil Engineers; and the rank, pay, and allowances of acting assistant civil engineers shall be the same as for ensigns; and said acting assistant civil engineers shall be subject to the laws governing pensions, gratuities, and other benefits in the naval service, but shall not be entitled to retirement or retirement pay. Said probationary period shall end two years from July first of the calendar year of original entry, and the number of appointments to said grade to be made in any calendar year shall be the number required to fill existing vacancies and prospective vacancies by operation of law in the authorized strength of said corps in the same calendar year: *Provided,* That graduate midshipmen and ensigns who may qualify under existing law for appointment to the Corps of Civil Engineers and shall be assigned to said corps shall be commissioned assistant civil engineers with the rank of ensign, and shall take rank and precedence in said corps in accordance with the official order of precedence of officers, which order shall not be changed. Upon the completion of the probationary period, as herein prescribed, acting assistant civil engineers shall, if qualified, be commissioned assistant civil engineers with the rank of lieutenant (junior grade), in the order of merit as determined by their probationary service, and under such rules as the Secretary of the Navy shall prescribe.

SEC. 42. That when in June of any year there is a prospect that the numbers resulting in the grade of civil engineer in the ranks of captain and commander after the ensuing July first promotions in accordance with the provisions of sections ten and forty of this act will exceed in said ranks combined twenty per centum of the full strength of the Corps of Civil Engineers, the Secretary of the Navy shall convene a board composed of two flag officers and the three highest ranking available civil engineers, and shall place at its disposal the service and medical records on file in the Navy Department of all the officers of the Corps of Civil Engineers in the ranks of captain and commander, or due by length of service for promotion to the rank of commander. Said board shall then, as soon as practicable on or after said July first, select for retirement, no member to vote on the name of any officer his senior, a sufficient number of said officers in said ranks as they will exist on said July first, after the promotions and voluntary retirements due on that date shall have been made, to reduce the total number of civil engineers of the ranks of captain and commander com-

not exceed ten per centum of the actual number in s
bined at the time of said transfer.

SEC. 43. That two officers not below the rank
commander shall be detailed as assistants to each
of the Navy Department, and, in case of the death
retirement, completion of term of appointment, abs
ness of the chief of the bureau, shall, in order of
otherwise directed by the President, as provided b
hundred and seventy-nine of the Revised Statutes
duties of such chief until his successor is appointed or
or sickness shall cease.

SEC. 44. That warrant officers in grades as a
present law and this act, including electricians, w
hereby authorized and established, may be appointed
dent as may be necessary for the naval service n
twenty in the same grade in any fiscal year. Electri
eligible for appointment as chief electricians after si
date of warrant, and the rank, pay, and allowances
grades of warrant officers and commissioned warrant
be the same as now provided by law for boatswa
boatswains, respectively, and the allowances shall
heat and light allowances to correspond to the
quarters: *Provided,* That all warrant officers shall
for promotion by such examining boards as the Sec
Navy shall designate: *Provided further,* That chi
and carpenters and chief electricians and electric
eligible for appointment to the grade of ensign unde
tions imposed by law upon the appointment to that g

and who shall pass such examinations as the Secretary of the Navy shall prescribe, may after twenty years from date of warrant be commissioned lieutenants (junior grade) not in the line of promotion; and chief sailmakers and chief pharmacists, not to exceed a total at any time of six in each grade, who shall have served zealously, and who shall pass such examinations as the Secretary of the Navy shall prescribe, may after twenty years from date of warrant be advanced in their respective grades to the rank of lieutenant (junior grade).

SEC. 45. That the full strength of the enlisted personnel of the Marine Corps of the United States on the active list shall be fixed hereafter on July first of each year at a number equivalent to twenty per centum of the full strength of the enlisted personnel of the Navy on the active list for the same year. The authorized numbers for any fiscal year shall be distributed in such noncommissioned and other ranks as the Secretary of the Navy shall determine on the recommendation of the Commandant of the Marine Corps, with the approval of the President: *Provided*, That the present authorized strength of the enlisted personnel of the Marine Corps shall not hereby be reduced: *And provided further*, That the authorized numbers of such enlisted personnel for the fiscal year ending June thirtieth, nineteen hundred and fourteen, shall be ten thousand five hundred.

SEC. 46. That the full strength of the commissioned personnel of the Marine Corps, line and staff, on the active list shall be fixed hereafter on July first of each year at forty such officers for each one thousand men, and fractions in proportion, of the full strength of the enlisted personnel of said corps on the active list; and the number of commissioned officers of the staff departments of the Marine Corps on the active list shall be seven and one-half per centum, to the nearest whole number, of the total of said commissioned personnel: *Provided*, That acting second lieutenants shall be counted in the total of said commissioned personnel: *Provided further*, That the present authorized strength of said total personnel shall not hereby be reduced: *And provided further*, That the authorized strength of said commissioned personnel of the Marine Corps shall not hereby be increased more than ten per centum nor decreased more than five per centum in any fiscal year.

SEC. 47. That on the passage of this act the authorized strength of the line of the Marine Corps on the active list shall be distributed in the several grades in the proportion of one general officer, four colonels, five lieutenant colonels, thirteen majors, fifty-two captains, and one hundred and ten first and second lieutenants and acting second lieutenants; and the same proportional distribution shall be followed hereafter in the data for the annual estimates required by section one of this act: *Provided*, That the authorized strength of the commissioned officers of the Marine Corps, line and staff, on the active list on the passage of this act and for the fiscal year ending June thirtieth, nineteen hundred and fourteen, shall not exceed three hundred and seventy-six, as herewith enumerated: One major general commandant, eight colonels, nine lieutenant colonels, twenty-five majors, ninety-eight captains, two hundred and six first and second lieutenants and acting second lieutenants, one adjutant and inspector with the rank of colonel, two assistant adjutants and inspectors, with the rank of lieutenant colonel, three assistant adjutants and inspectors with the rank of major, one quartermaster with the rank of colonel, two assistant quartermasters with the rank of lieutenant colonel, three assistant quartermasters with the rank of major, eleven assistant quartermasters with the rank of captain, one paymaster with the rank of colonel, one assistant paymaster with the rank of lieutenant colonel, two assistant paymasters with the rank of major, and two assistant paymasters with the rank of captain.

SEC. 48. That hereafter appointments to the Marine Corps, except the appointment thereto of graduate midshipmen and ensigns, who shall take rank as provided in section nine of this act, shall be made only after such prospective appointees shall have served a probationary period of two years, as nearly as may be practicable, as acting second lieutenant, which grade is hereby authorized and established. Candidates for appointment to such grade shall be between the ages of nineteen and twenty-three years at the time of such appointment; which shall be made by and shall be revocable at the will of the Secretary of the Navy, and shall otherwise be subject to existing law for appointments to the Marine Corps; and the rank, pay, and allowances of acting second lieutenants shall be the same as for second lieutenants; and said acting second lieutenants shall be subject to the laws governing pensions, gratuities, and other benefits in the Marine Corps, but

shall not be entitled to retirement or retirement pay. Said probationary period shall end two years from July first of the calendar year of original entry, and the number of appointments to said grade to be made in any calendar year shall be the number required to fill existing vacancies and prospective vacancies by operation of law in the authorized strength of the commissioned personnel of said corps in the same calendar year.

SEC. 49. That upon the completion of the probationary service as prescribed in section forty-eight preceding, acting second lieutenants shall, if qualified, be commissioned second lieutenants in the order of merit as determined by their probationary service, and under such rules as the Secretary of the Navy shall prescribe; and such commissions shall date from July first of the calendar year of appointment as acting second lieutenant, but shall not carry any claim for back pay. Officers not so commissioned shall be honorably discharged from the service. Second lieutenants, after three years' total service from date of first commission, shall, if qualified, be promoted to the grade of first lieutenant. Thereafter officers of the line of the Marine Corps may be promoted at any time, in the order of seniority, to fill a vacancy in the next higher grade, and shall be promoted, subject to the examination required by law, after completing periods of total service, counting from July first of the calendar year of date of first commission, as herewith enumerated: First lieutenants, ten years; captains, eighteen years; majors, twenty-four years; lieutenant colonels, thirty years: *Provided*, That officers who shall have gained or lost numbers shall be considered to have gained or lost service accordingly: *And provided further*, That such promotions, for the first ten years after the passage of this act, shall not cause at any time an excess in any grade of more than ten per centum of the authorized numbers in such grade; nor after ten years an excess at the time of more than fifteen per centum in any grade; and said excess shall be reduced immediately by retirements from the whole grade, as provided in section fifty-two of this act.

SEC. 50. That the numbers in the several grades of the Marine Corps determined by the requirements of this act on July first of any year shall obtain throughout the fiscal year, and vacancies occurring during the year shall, subject to the provisions of section forty-nine preceding regarding the promotion of acting second lieutenants, be filled in order of seniority from the grade below.

active list not below the rank of lieutenant colonel, v
office as such major general commandant for a
years, but such appointment shall not create a va
grade from which such officer may be appointed or
may be promoted during the period of such appoi
vided, That any officer who shall be retired from
while holding the office of major general comman
shall have served a full term as major general comm
upon retirement, be retired with the rank, pay, an
authorized by law for a major general retired.

SEC. 52. That when in June of any year there is a
the numbers of colonels, lieutenant colonels, major
of the line of the Marine Corps that will result afte
July first promotions in accordance with the provisi
forty nine of this act will exceed the authorized nu
respective grades, the Secretary of the Navy shall co
composed of two flag officers and the three highest r
able general officers or colonels of the line, and sha
disposal the service and medical records on file in t
partment of all the officers of the line in the grad
lieutenant colonel, major, and captain, or due by leng
for promotion to the grade of captain. Said board
soon as practicable on or after said July first, select f
no member to vote on the name of any officer his seni
number of said officers in each grade as it will exist
first, after the promotions and voluntary retirements
date shall have been made, to reduce the total numbe

and action thereon shall be in accordance with the requirements and subject to the provisos of section thirteen of this act.

SEC. 53. That the total authorized strength of the staff departments as required by section forty-six of this act shall be assigned in the ratio, to the nearest whole number, as nearly as may be practicable, of twenty per centum to the Adjutant and Inspector's Department, and fifty-five per centum to the Quartermaster's Department, and twenty-five per centum to the Paymaster's Department. The distribution in grades in each department shall be in the same proportions, to the nearest whole number, as nearly as may be practicable, as required for the line by section forty-seven of this act, down to and including majors, with the addition in the Quartermaster's Department of three captains for every major of the authorized proportion, and in the Paymaster's Department two captains for every major of said authorized proportion: *Provided,* That the proportion assigned to general officers in the line shall be included with that of colonels in the line in determining the number of colonels in the staff department.

SEC. 54. That the provisions of this act relating to compulsory retirement of officers in excess in any grade, except for age or disability, shall not apply in time of war or threatened war.

SEC. 55. That all acts and parts of acts, so far as they conflict with the provisions of this act, be, and the same are hereby, repealed.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CONSIDERATION OF THE CALIBER OF THE MAIN BATTERY OF BATTLESHIPS.

By D. José Maria Cervera, Captain of Artillery, Spanish Navy.

Translated by Lieut.-Commander Stephen V. Graham, U. S. Navy, from *Revista General de Marina.*

The selection of the gun that is to form the main battery of a battleship is a problem that is to be solved by the artillerist, the sea-going officer, and the naval constructor, since these three occupy different points of view which it is neccessary to embrace and harmonize, in order to arrive at the correct solution.

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In the United States the same course has been followed, and, while the 14-inch guns of 45 calibers form the main battery of the *New York* and the *Texas,* it is said that a 16-inch naval gun is in the experimental stage.

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As is seen, all of the powers are increasing the caliber of their heavy guns, and the 13.5-inch gun appears to be giving place to the 15-inch and 16-inch gun. Nevertheless, some naval authorities indicate the probability and desirability of the return to more moderate calibers, or, at least, experience some doubt as to the maximum efficiency to be obtained in naval vessels by the use of such exaggerated calibers. Even Brassey's Annual, so enamored

act: *Provided,* That the present authorized strength of the Corps of Civil Engineers shall not hereby be reduced: *Provided further,* That the total authorized strength of said corps shall not hereby be increased more than ten per centum nor decreased more than five per centum in any fiscal year: *And provided further,* That the authorized strength of the Corps of Civil Engineers for the fiscal year ending June thirtieth, nineteen hundred and fourteen, shall be forty-four.

SEC. 40. That hereafter the Corps of Civil Engineers shall comprise civil engineers with the rank of captain, commander, and lieutenant commander, assistant civil engineers with the rank of lieutenant, lieutenant (junior grade), and ensign, and acting assistant civil engineers with the rank of ensign. On the passage of this act the active list of said corps shall be arranged in the several grades and ranks in such manner that officers of said corps shall have the same rank, so far as authorized for the Corps of Civil Engineers, and as specified in this section, as line officers of the same precedence; and thereafter officers of the Corps of Civil Engineers shall be promoted to the next higher of said ranks, with the corresponding grade, when the line officer with whom or next after whom they take precedence is promoted to the corresponding grade in the line: *Provided,* That no officer shall be promoted in the rank in the Corps of Civil Engineers until he shall have passed such examinations as the Secretary of the Navy shall prescribe.

SEC. 41. That hereafter appointments to the Corps of Civil Engineers, except the appointments thereto of graduate midshipmen and ensigns, as provided in section nine of this act, shall be made only after such prospective appointees shall have served a probationary period of two years, as nearly as may be practicable, as acting assistant civil engineer, which grade is hereby authorized and established. Candidates for appointment to said grade shall be graduates of a school of civil engineering of good standing, shall qualify in a competitive professional examination before a board of officers of said corps designated by the Secretary of the Navy, and under such rules as the Secretary of the Navy shall prescribe, and shall be between the ages of twenty-one and twenty-six years at the time of such appointment, which shall be made by and shall be revocable at the will of the Secretary of the Navy, and shall otherwise be subject to existing law for appointments

to the Corps of Civil Engineers; and the rank, pay, and allowances of acting assistant civil engineers shall be the same as for ensigns; and said acting assistant civil engineers shall be subject to the laws governing pensions, gratuities, and other benefits in the naval service, but shall not be entitled to retirement or retirement pay. Said probationary period shall end two years from July first of the calendar year of original entry, and the number of appointments to said grade to be made in any calendar year shall be the number required to fill existing vacancies and prospective vacancies by operation of law in the authorized strength of said corps in the same calendar year: *Provided,* That graduate midshipmen and ensigns who may qualify under existing law for appointment to the Corps of Civil Engineers and shall be assigned to said corps shall be commissioned assistant civil engineers with the rank of ensign, and shall take rank and precedence in said corps in accordance with the official order of precedence of officers, which order shall not be changed. Upon the completion of the probationary period, as herein prescribed, acting assistant civil engineers shall, if qualified, be commissioned assistant civil engineers with the rank of lieutenant (junior grade), in the order of merit as determined by their probationary service, and under such rules as the Secretary of the Navy shall prescribe.

SEC. 42. That when in June of any year there is a prospect that the numbers resulting in the grade of civil engineer in the ranks of captain and commander after the ensuing July first promotions in accordance with the provisions of sections ten and forty of this act will exceed in said ranks combined twenty per centum of the full strength of the Corps of Civil Engineers, the Secretary of the Navy shall convene a board composed of two flag officers and the three highest ranking available civil engineers, and shall place at its disposal the service and medical records on file in the Navy Department of all the officers of the Corps of Civil Engineers in the ranks of captain and commander, or due by length of service for promotion to the rank of commander. Said board shall then, as soon as practicable on or after said July first, select for retirement, no member to vote on the name of any officer his senior, a sufficient number of said officers in said ranks as they will exist on said July first, after the promotions and voluntary retirements due on that date shall have been made, to reduce the total number of civil engineers of the ranks of captain and commander com-

bined on said July first to said twenty per centum of the full strength of the Corps of Civil Engineers. The same procedure in regard to oaths (or affirmation) shall be followed as prescribed in section twelve of this act, and the finding and action thereon shall be in accordance with the requirements and subject to the provisos of section thirteen of this act: *Provided,* That the combined number of transfers of such officers to the retired list from said ranks of captain and commander on July first of any year shall not exceed ten per centum of the actual number in said ranks combined at the time of said transfer.

SEC. 43. That two officers not below the rank of lieutenant commander shall be detailed as assistants to each of the bureaus of the Navy Department, and, in case of the death, resignation, retirement, completion of term of appointment, absence, or sickness of the chief of the bureau, shall, in order of rank, unless otherwise directed by the President, as provided by section one hundred and seventy-nine of the Revised Statutes, perform the duties of such chief until his successor is appointed or such absence or sickness shall cease.

SEC. 44. That warrant officers in grades as authorized by present law and this act, including electricians, which grade is hereby authorized and established, may be appointed by the President as may be necessary for the naval service not to exceed twenty in the same grade in any fiscal year. Electricians shall be eligible for appointment as chief electricians after six years from date of warrant, and the rank, pay, and allowances in the several grades of warrant officers and commissioned warrant officers shall be the same as now provided by law for boatswains and chief boatswains, respectively, and the allowances shall include also heat and light allowances to correspond to the allowance of quarters: *Provided,* That all warrant officers shall be examined for promotion by such examining boards as the Secretary of the Navy shall designate: *Provided further,* That chief carpenters and carpenters and chief electricians and electricians shall be eligible for appointment to the grade of ensign under the restrictions imposed by law upon the appointment to that grade of other commissioned warrant officers and warrant officers: *And provided further,* That chief boatswains, chief gunners, chief machinists, chief carpenters, and chief electricians, not to exceed a total at any time of six in each grade, who shall have served zealously,

and who shall pass such examinations as the Secretary of the Navy shall prescribe, may after twenty years from date of warrant be commissioned lieutenants (junior grade) not in the line of promotion; and chief sailmakers and chief pharmacists, not to exceed a total at any time of six in each grade, who shall have served zealously, and who shall pass such examinations as the Secretary of the Navy shall prescribe, may after twenty years from date of warrant be advanced in their respective grades to the rank of lieutenant (junior grade).

SEC. 45. That the full strength of the enlisted personnel of the Marine Corps of the United States on the active list shall be fixed hereafter on July first of each year at a number equivalent to twenty per centum of the full strength of the enlisted personnel of the Navy on the active list for the same year. The authorized numbers for any fiscal year shall be distributed in such noncommissioned and other ranks as the Secretary of the Navy shall determine on the recommendation of the Commandant of the Marine Corps, with the approval of the President: *Provided,* That the present authorized strength of the enlisted personnel of the Marine Corps shall not hereby be reduced: *And provided further,* That the authorized numbers of such enlisted personnel for the fiscal year ending June thirtieth, nineteen hundred and fourteen, shall be ten thousand five hundred.

SEC. 46. That the full strength of the commissioned personnel of the Marine Corps, line and staff, on the active list shall be fixed hereafter on July first of each year at forty such officers for each one thousand men, and fractions in proportion, of the full strength of the enlisted personnel of said corps on the active list; and the number of commissioned officers of the staff departments of the Marine Corps on the active list shall be seven and one-half per centum, to the nearest whole number, of the total of said commissioned personnel: *Provided,* That acting second lieutenants shall be counted in the total of said commissioned personnel: *Provided further,* That the present authorized strength of said total personnel shall not hereby be reduced: *And provided further,* That the authorized strength of said commissioned personnel of the Marine Corps shall not hereby be increased more than ten per centum nor decreased more than five per centum in any fiscal year.

SEC. 47. That on the passage of this act the authorized strength of the line of the Marine Corps on the active list shall be distributed in the several grades in the proportion of one general officer, four colonels, five lieutenant colonels, thirteen majors, fifty-two captains, and one hundred and ten first and second lieutenants and acting second lieutenants; and the same proportional distribution shall be followed hereafter in the data for the annual estimates required by section one of this act: *Provided*, That the authorized strength of the commissioned officers of the Marine Corps, line and staff, on the active list on the passage of this act and for the fiscal year ending June thirtieth, nineteen hundred and fourteen, shall not exceed three hundred and seventy-six, as herewith enumerated: One major general commandant, eight colonels, nine lieutenant colonels, twenty-five majors, ninety-eight captains, two hundred and six first and second lieutenants and acting second lieutenants, one adjutant and inspector with the rank of colonel, two assistant adjutants and inspectors, with the rank of lieutenant colonel, three assistant adjutants and inspectors with the rank of major, one quartermaster with the rank of colonel, two assistant quartermasters with the rank of lieutenant colonel, three assistant quartermasters with the rank of major, eleven assistant quartermasters with the rank of captain, one paymaster with the rank of colonel, one assistant paymaster with the rank of lieutenant colonel, two assistant paymasters with the rank of major, and two assistant paymasters with the rank of captain.

SEC. 48. That hereafter appointments to the Marine Corps, except the appointment thereto of graduate midshipmen and ensigns, who shall take rank as provided in section nine of this act, shall be made only after such prospective appointees shall have served a probationary period of two years, as nearly as may be practicable, as acting second lieutenant, which grade is hereby authorized and established. Candidates for appointment to such grade shall be between the ages of nineteen and twenty-three years at the time of such appointment; which shall be made by and shall be revocable at the will of the Secretary of the Navy, and shall otherwise be subject to existing law for appointments to the Marine Corps; and the rank, pay, and allowances of acting second lieutenants shall be the same as for second lieutenants; and said acting second lieutenants shall be subject to the laws governing pensions, gratuities, and other benefits in the Marine Corps, but

shall not be entitled to retirement or retirement pay. Said probationary period shall end two years from July first of the calendar year of original entry, and the number of appointments to said grade to be made in any calendar year shall be the number required to fill existing vacancies and prospective vacancies by operation of law in the authorized strength of the commissioned personnel of said corps in the same calendar year.

SEC. 49. That upon the completion of the probationary service as prescribed in section forty-eight preceding, acting second lieutenants shall, if qualified, be commissioned second lieutenants in the order of merit as determined by their probationary service, and under such rules as the Secretary of the Navy shall prescribe; and such commissions shall date from July first of the calendar year of appointment as acting second lieutenant, but shall not carry any claim for back pay. Officers not so commissioned shall be honorably discharged from the service. Second lieutenants, after three years' total service from date of first commission, shall, if qualified, be promoted to the grade of first lieutenant. Thereafter officers of the line of the Marine Corps may be promoted at any time, in the order of seniority, to fill a vacancy in the next higher grade, and shall be promoted, subject to the examination required by law, after completing periods of total service, counting from July first of the calendar year of date of first commission, as herewith enumerated: First lieutenants, ten years; captains, eighteen years; majors, twenty-four years; lieutenant colonels, thirty years: *Provided,* That officers who shall have gained or lost numbers shall be considered to have gained or lost service accordingly: *And provided further,* That such promotions, for the first ten years after the passage of this act, shall not cause at any time an excess in any grade of more than ten per centum of the authorized numbers in such grade; nor after ten years an excess at the time of more than fifteen per centum in any grade; and said excess shall be reduced immediately by retirements from the whole grade, as provided in section fifty-two of this act.

SEC. 50. That the numbers in the several grades of the Marine Corps determined by the requirements of this act on July first of any year shall obtain throughout the fiscal year, and vacancies occurring during the year shall, subject to the provisions of section forty-nine preceding regarding the promotion of acting second lieutenants, be filled in order of seniority from the grade below.

SEC. 51. That the general officers required by section forty-seven of this act shall be selected by the President from the colonels or lieutenant colonels of the line on the active list. The general officers other than the commandant shall have the rank of brigadier general. Hereafter, when a vacancy shall occur in the office of major general commandant of the Marine Corps, the President shall appoint to such vacancy, by and with the advice and consent of the Senate, an officer of the Marine Corps on the active list not below the rank of lieutenant colonel, who shall hold office as such major general commandant for a term of four years, but such appointment shall not create a vacancy in the grade from which such officer may be appointed or to which he may be promoted during the period of such appointment: *Provided,* That any officer who shall be retired from active service while holding the office of major general commandant, or who shall have served a full term as major general commandant, shall, upon retirement, be retired with the rank, pay, and allowances authorized by law for a major general retired.

SEC. 52. That when in June of any year there is a prospect that the numbers of colonels, lieutenant colonels, majors, or captains of the line of the Marine Corps that will result after the ensuing July first promotions in accordance with the provisions of section forty nine of this act will exceed the authorized numbers of their respective grades, the Secretary of the Navy shall convene a board composed of two flag officers and the three highest ranking available general officers or colonels of the line, and shall place at its disposal the service and medical records on file in the Navy Department of all the officers of the line in the grades of colonel, lieutenant colonel, major, and captain, or due by length of service for promotion to the grade of captain. Said board shall then, as soon as practicable on or after said July first, select for retirement, no member to vote on the name of any officer his senior, a sufficient number of said officers in each grade as it will exist on said July first, after the promotions and voluntary retirements due on that date shall have been made, to reduce the total number of colonels, lieutenant colonels, majors, and captains of the line on said July first to the authorized numbers of said respective grades. The same procedure in regard to oaths (or affirmation) shall be followed as prescribed in section twelve of this act, and the finding

and action thereon shall be in accordance with the requirements and subject to the provisos of section thirteen of this act.

SEC. 53. That the total authorized strength of the staff departments as required by section forty-six of this act shall be assigned in the ratio, to the nearest whole number, as nearly as may be practicable, of twenty per centum to the Adjutant and Inspector's Department, and fifty-five per centum to the Quartermaster's Department, and twenty-five per centum to the Paymaster's Department. The distribution in grades in each department shall be in the same proportions, to the nearest whole number, as nearly as may be practicable, as required for the line by section forty-seven of this act, down to and including majors, with the addition in the Quartermaster's Department of three captains for every major of the authorized proportion, and in the Paymaster's Department two captains for every major of said authorized proportion: *Provided*, That the proportion assigned to general officers in the line shall be included with that of colonels in the line in determining the number of colonels in the staff department.

SEC. 54. That the provisions of this act relating to compulsory retirement of officers in excess in any grade, except for age or disability, shall not apply in time of war or threatened war.

SEC. 55. That all acts and parts of acts, so far as they conflict with the provisions of this act, be, and the same are hereby, repealed.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CONSIDERATION OF THE CALIBER OF THE MAIN BATTERY OF BATTLESHIPS.

By D. José Maria Cervera, Captain of Artillery, Spanish Navy,

Translated by Lieut.-Commander Stephen V. Graham, U. S. Navy, from *Revista General de Marina.*

The selection of the gun that is to form the main battery of a battleship is a problem that is to be solved by the artillerist, the sea-going officer, and the naval constructor, since these three occupy different points of view which it is neccessary to embrace and harmonize, in order to arrive at the correct solution.

At the present moment there exists a strong current of opinion in favor of an increase of caliber, as shown in the armament of the most recent ships of the principal naval powers.

England initiated the movement, for, while the *Dreadnought* mounted 12-inch guns of 45 calibers in length, and the *St. Vincent* 12-inch of 50 calibers in length, the *Orion* class will carry 13.5-inch guns of 45 calibers in length.

In the United States the same course has been followed, and, while the 14-inch guns of 45 calibers form the main battery of the *New York* and the *Texas,* it is said that a 16-inch naval gun is in the experimental stage.

Germany, for her part, has advanced rapidly from 11 to 12 and 14 inches.

As is seen, all of the powers are increasing the caliber of their heavy guns, and the 13.5-inch gun appears to be giving place to the 15-inch and 16-inch gun. Nevertheless, some naval authorities indicate the probability and desirability of the return to more moderate calibers, or, at least, experience some doubt as to the maximum efficiency to be obtained in naval vessels by the use of such exaggerated calibers. Even Brassey's Annual, so enamored

of English ideas, in its last edition, states that it is not easy to predict the size and power of the gun that will prevail.

It is not, as might appear at the first view, the progress in armor which has primarily necessitated the increase of caliber, for precisely during the time that armor plate has, so to speak, remained stationary, calibers have been increasing.

Discounting the possibility of superior armor to be obtained in the near future, as seems to be indicated by the results of tests of the Simpson plates, there exist other powerful reasons for such increase, which we are going to expose, together with proportionate views of the other side of the question.

We will consider in the first place the penetrating power of the various guns, and, estimating the usual battle ranges to be those comprised between 4000 and 7000 meters, we present the following table from an article read by Count Giraldi, director of the Armstrong factory at Pozzuli, at the first Congress of the Society of the Italian Naval Architects and Marine Engineers, held at Rome, in the middle of last November.

Range	Model 1910 12-inch projectile, wt. 972 lbs., 50 cal.	13.5-inch projectile, wt. 1245 lbs., I. V. 2700 fs., 45 cal.	14-inch projectile, wt. 1566 lbs., I. V. 2500 fs., 45 cal.	15-inch projectile, wt. 1930 lbs., I. V. 2500 fs., 45 cal.	16-inch projectile, wt. 2343 lbs., I. V. 2500 fs., 45 cal.
Yards	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
4364	16.1	17.1	18.15	19.5	21.1
5357	15.4	16.3	17.1	18.6	20.15
6547	13.5	15.3	16.2	17.7	19.3
7638	12.6	14.3	15.35	16.9	18.5

This table shows the thickness of plates of Krupp armor which would be penetrated upon being struck normally by the projectiles of different calibers at ranges between 4000 and 7000 meters, which ranges appear to be the greatest at which it is advisable to fight with armor-piercing projectiles.

Examining the table it is seen that, in some cases, the penetrating power, with relation to the caliber of 12-inch, increases even as much as fifty per cent, and that an effective increase of twenty per cent can be counted upon, which affords a good margin for future armors of resistance superior to the present Krupp plates. And so much more advantage is obtained, if we have, for example, a 12-inch projectile attacking with success under given conditions, a plate of 12 inches in thickness. A 13.5-inch projectile will penetrate with more ease under the same conditions a plate of

13.5 inches thickness, since the penetrating power increases much more rapidly with an increase of caliber than the resistance of a plate increases with analogous increase of thickness. Since the thickness of armor cannot be increased indefinitely, there will always be, using superior calibers, an excess of penetrating power over the resistance of armor.

We have considered only normal impact, which cannot be counted upon in naval actions; and penetration diminishes with the increase of incidence, until it becomes nil, so that, from this point of view, not much greater results would be obtained by attacking with a heavier projectile resulting from an increase of caliber. For this reason, and because present battleships, as well as those under construction, are protected by a belt of 11.8 inches thickness, which can be penetrated by a 12-inch gun, Count Giraldi recommends not increasing caliber beyond this limit.

At present there is a general tendency in all navies to reduce in number the variety of projectiles to be used, pursuing the ideal of arriving at a "single type" which will satisfy all the exigencies of a modern battle; that is to say, which will possess sufficient penetrating power united with greater destructive power by the explosion of its charge.

The French Navy has led in this movement with its *obus alourdi* (weighted shell), designed to combine the effects of an armor-piercing shell of large capacity with walls of sufficient thickness to resist impact, pierce armor of medium thickness, bursting behind it by the action of its large charge and the delayed action fuze with which it is equipped.

The increase of caliber also favors the realization of this ideal by making it practicable for projectiles to carry a large quantity of high explosive, the utility of which was demonstrated by its destructive effect in the Russo-Japanese war.

In fact, the weight of a projectile increases rapidly with the caliber; the weight of the explosive charge and the destructive power increasing consequently in equal proportion. The current technical opinion is that a 12-inch projectile of the approximate weight of 990 lbs. can carry an explosive charge of the weight equal to 3 per cent of the total, that is 29.7 lbs., without losing, on this account, any considerable amount of its power of penetration. It does not appear unreasonable to suppose that a 14-inch projectile, with a weight of 1540 lbs., can carry 3.5 per cent of its

weight, or 54.1 lbs., of explosive. No more does it appear excessive to admit that a 15-inch projectile, with a weight of 1760 lbs., will carry 4 per cent of explosive, that is, 70.4 lbs., and, if it is considered that the high explosive shells (when such are provided in addition to purely armor-piercing shells) carry a bursting charge of 75 per cent of the total weight of the projectile, we have in the case of the 12-inch high explosive shell a bursting charge of 74 lbs., which is practically the weight of the bursting charge of an armor-piercing shell of 15-inch caliber. From this it is seen that with this caliber the ideal of the above-mentioned "single type" of projectile is realized.

In the paper above mentioned, Count Giraldi attempted to prove the contrary, claiming that the armor-piercing shell of to-day carries a bursting charge of 2 per cent of its weight, and that, even if the projectile of the "single type" could increase this to 3.25 per cent, or 3.5 per cent, this limit could not be exceeded; and, therefore, in order to obtain the 74 lbs. of the present 12-inch semi-armor-piercing shell, it would be necessary to increase the caliber to at least 16 inches. For this reason he considers the adoption of a projectile of the "single type" as very doubtful; and when it is further considered that modern high explosives are much more powerful than those of the past, it appears to him unnecessary to increase the caliber above 12 inches, with a length of 45 or 50 calibers. It is true that a projectile from such a gun (12-inch) is capable of destroying the superstructures of an enemy's ship, but it is also true that no vital parts of a ship are situated behind the superstructures.

There are, in addition, other important reasons for advocating an increase of caliber, among which is the very important one of erosion of the bore.

It is true that great effects may be obtained with relatively small calibers, but it is always at the cost of wearing down of the metal and the erosion produced by large charges of nitro-glycerin powders (almost universally used) in spite of the favorable conditions under which these are manufactured at present, the temperature of explosion being reduced by the addition of hydrocarburates. This aspect is very interesting, not only for economic, but also for military reasons, since the erosion suffered by the rifling, and in one word, the bore, diminishes the force of projection and density of loading (by advancing the projectile into

its seat), affecting sensibly the precision of the weapon and diminishing the number of rounds of which it is capable, which might be of grave consequence in a campaign.

Also, since superior caliber provides for a projectile of greater weight, the muzzle velocity may be reduced a given amount and still maintain the same striking energy, and this increases considerably the life of the weapon. However, with these guns the trajectories are less flat than with a gun of 12-inch caliber, which is not desirable in naval gunnery. Consequently, it is advantageous to increase the muzzle velocity in such degree as not to lose advantage of the greater life of the gun and yet obtain a trajectory with a maximum ordinate which will satisfy the necessities of naval combat.

For this reason the 14-inch gun of the United States was given originally an initial velocity of 2580 feet per second, and there is a tendency to increase this to 2680 feet per second.

Another advantage of the larger calibers is the moral effect they impress upon the men who serve them, since they are beyond doubt more impressed with the power of the individual gun they are serving than with the number of guns which their ship carries, and they will be more confident and more certain of victory if they are firing guns that are more powerful than those of the enemy, or, at any rate, those that equal the guns of the enemy. Incidentally it should be mentioned that the ammunition supply is simplified; the direction and control of fire is facilitated; first because the impact of larger shells is more easily seen, and, also, for a given displacement there are fewer guns to control. This has, however, a serious disadvantage, which will be mentioned later.

The advantages and disadvantages of the increase of calibers above 12 inches having been analyzed, we will touch in passing, upon the problem of these most important installations.

We will consider the number of guns that a battleship can mount, taking 20 per cent of the displacement as available for armament. Deducting the 2 per cent necessary for secondary battery, there remain 18 per cent for the principal installations, so that, since the complete weight of the armament of ten guns, including 120 rounds of ammunition for each, amounts to 3250, 3950, and 4750 tons, according as the guns are of 12-inch, 13.5 inch, 14-inch, respectively, we are brought to displacements of 18,000,

22,000, and 26,500 tons, as the case may be. If it were desired, for example, not to exceed 22,000 tons displacement, it would be necessary to renounce mounting 14-inch guns if we wished to install ten large guns.

With the displacement mentioned a ship could carry twelve guns of 12-inch, ten of 13.5-inch, or eight of 14-inch. These figures throw doubt upon the advisability of exceeding a caliber of 12 inches, since the offensive power being thus concentrated in so small a number of pieces (eight if 14-inch caliber be adopted) it is much to be feared that a casualty would disable an important aliquot part of the armament.

As to the type of turret to be selected, double or triple, there are authorities who assign to each gun of 12-inch caliber a weight of 250 tons in the first case, and 150 tons in the second, which shows an important economy of weight amounting to one gun in ten, in case triple turrets are used.

Certain English and Italian publications claim that the saving of weight is even greater.

The triple turret has the further advantage of requiring a less numerous personnel and of simplifying fire control. But it possesses the disadvantage of a greater turning moment when the side guns are fired, and the accumulation of gases.

Italy has been the first nation to launch a battleship carrying triple turrets, but, as Sir William White says, the sanction of this practice depends for proof upon rapidity of loading and firing, and there still remains the risk of disability of a large number of major guns at the same time.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

DISPERSION AND ACCURACY OF FIRE.

By LIEUTENANT BYRON A. LONG, U. S. Navy.

In what way must development tend in order to increase the number of hits at battle ranges?

One frequently hears after a practice: "We straddled the target and would have made a number of hits had the dispersion been less." From others is heard: "Our salvos were beautifully grouped, but they were not on the target. More hits could have been made if dispersion had been greater."

In any analysis of gun fire it is evident that the hitting of a target depends on two factors:

(a) Range error and lateral error;

(b) Dispersion, both vertically and laterally.

For convenience they may be referred to as fire-control errors and dispersion errors.

At target practice an attempt is made to place the mean point of impact of each salvo exactly in the center of the target, but this is impracticable of attainment for obvious reasons, and it is found that the mean point of impact is either short of the target or beyond it. Similarly, the mean point of impact is either to the right or the left of the centre of the target.

On each salvo, therefore, there is a definite range error, and a definite lateral error. The average of these errors for a target practice gives an average range error and an average lateral error for each firing ship.

It is evident, too, that each salvo will be dispersed both vertically and laterally.

These conditions must be fully appreciated; the two kinds of errors (fire-control errors and dispersion errors) occur on every salvo fired, and they embrace every error that exists in the firing of guns.

These two errors vary on each salvo, and are closely associated with each other.

Let us consider first (a) the range error and the lateral error.

If the correct sight-bar range and the correct deflection were known for each salvo, it is evident that hitting would be a maximum when there was no dispersion, vertically or laterally. That is, with known sight-bar range, and known deflection, all dispersion should be wholly eliminated.

The range and deflection are not accurately known, however: they vary from salvo to salvo. The spotter, with the aid of fire-control instruments, attempts to keep the range and deflection accurately, but errors exist on each salvo.

Admitting then that there must be a range error and a lateral error on each salvo, it is important to observe what effect on hitting is caused by dispersion.

(Dispersion is a very loosely used word. So far as concerns gunnery it should be used to indicate the average distance of shots from the mean point of impact; it is the mean vertical dispersion, or the mean lateral dispersion. If it is used to indicate the distance between the outer shots of a salvo, it becomes confusing; furthermore, the distance between the outer shots of a salvo is of little consequence, and has not the mathematical significance conveyed by the term "mean dispersion." Dispersion will therefore be used to indicate mean vertical dispersion, or mean lateral dispersion.)

It will be found that a flat trajectory gun has large horizontal dispersion, but small vertical dispersion. At longer ranges the horizontal dispersion decreases, but the vertical dispersion increases. We are concerned principally with vertical errors, and it avoids confusion and makes the subject much clearer to consider all errors as either vertical or lateral. All horizontal, or range errors are therefore reduced to vertical errors to simplify the problem.

If it were known that on any salvo there would be a definite range error and a definite lateral error, it can be shown mathematically that, neglecting the smaller terms, the greatest possible number of hits would be made when the dispersion of the salvo is:

$$D_r = \tfrac{1}{2}\sqrt{\frac{8.57\,E_r^2}{\pi} + s^2}$$

$$D_l = \tfrac{1}{2}\sqrt{\frac{8.57\,E_l^2}{\pi} + w^2}$$

(1) E_v=mean vertical deviation of mean point of impact of salvos (range error) in feet.
(2) E_l=mean lateral deviation of mean point of impact of salvos (lateral error) in feet.
(3) D_v=mean vert. deviation of gun (dispersion) in feet.
(4) D_l=mean lateral deviation of gun (dispersion) in feet.
(5) s=height of target, in feet.
(6) w=width of target, in feet.

For practical purposes the dispersion that produces the greatest number of hits may be taken as 80 per cent of the fire-control errors.

If the dispersion of the salvo is greater or less than the values given, the hits will decrease.

On every salvo there is a range error and a lateral error, and consequently there is a definite dispersion for each salvo that will give the greatest number of hits.

It is evident that the range error and the dispersion are closely associated with each other. Hitting cannot be increased by reducing the dispersion, or increasing it, unless the effect on the range error is considered—but, on the other hand hitting can always be increased by reducing the fire-control error, no matter what the dispersion is. The question is frequently asked, should dispersion be increased or decreased to increase the hitting?

Even supposing that all dispersion could be eliminated, and that all the shots of a salvo fell in a point, it is evident that range errors and lateral errors of considerable magnitude would still exist. We should then be confronted with the fact that having eliminated all dispersion the hitting could actually be increased by introducing dispersion. We may accept as a settled fact, then, that in gunnery a certain amount of dispersion is necessary to produce the greatest number of hits.

There is no doubt that spotting is facilitated if the dispersion is small, and the fire-control error should thereby be reduced. This is a very important point. Were it not for this consideration, it would not be necessary to dwell on dispersion until the practical limits of the fire-control error had been established. Then it could be ascertained whether the existing dispersion should be increased or decreased.

An examination of firings of 8-inch and 12-inch guns of the Atlantic fleet, in the practices of the fall of 1911, and the spring

of 1912, shows that, maintaining the same fire-control errors, the hitting would have been increased by having more dispersion. At a range of 10,000 yards the vertical dispersion should have been increased 15 to 30 per cent, and the lateral dispersion as much in one case as 40 per cent to ensure the maximum hitting with the existing fire-control errors.

It is important to understand this clearly. If the fire-control error had remained unchanged, the dispersion could have been nearly trebled in some cases without decreasing the hits, and an increase of dispersion of 15 to 30 per cent would have actually increased the hitting.

On the other hand, no matter whether the dispersion were large or small, every decrease in the fire-control error would have resulted in a direct increase of hits.

There is no doubt that decreased dispersion will assist the spotter to reduce the fire-control error, but as considerable dispersion will always be present, the probable reduction in the fire-control error due to decreased dispersion cannot be stated. Furthermore, it is important to keep in mind that the spotter is one element only in fire control, and the excellent work of a spotter may be vitiated by the other factors of the fire control. In some systems, too, more dependence is placed on range finders than on spotters, and dispersion would therefore not influence the fire-control errors.

In contemplating the subject one fact stands out apparent—all energy must be devoted to reducing in every way possible the fire-control errors, for no matter what the dispersion, any decrease in range and deflection errors at once increases the hitting. The crying need is for more accurate tracking and better spotting—in short, better fire control.

In order to assist the spotter there should be the least possible dispersion.

When everything possible has been done to reduce fire-control errors, and dispersion has been kept as small as possible, target practice firings will show what range and deflection errors are obtained. These firings will also give the dispersion of salvos, and it will be apparent at once whether the dispersion is too small or too great to ensure the greatest number of hits.

DISCUSSION.

Dispersion and Accuracy of Fire.

REAR-ADMIRAL B. A. FISKE, U. S. Navy.—While it is clear that Lieutenant Long's able article brings out sharply an important but neglected truth, it is equally clear that its effect will be beneficial only in so far as the inference drawn from it is correct.

If the inference drawn be incorrect, the lesson it conveys may be ignored: it may even be perverted to a wrong use.

That an incorrect inference may be drawn by some officers seems probable: in fact it is believed that some officers have actually drawn the incorrect inference that the article teaches that our salvos are bunched too closely.

Of course, the correct inference is that the article teaches that our fire control errors are too great, and should be reduced.

If this inference be drawn, the article will be most beneficial, because everybody will then see the necessity for training men to use the range finder.

CAPTAIN J. H. GLENNON, U. S. Navy.—I think the discussion of this question could be improved by strict adherence to technical terms, the present tendency being to use such terms too loosely. This loose use of words is at first a convenience, but in the last analysis leads to confusion. There is a mathematical theory of errors quite as exact as other mathematics based primarily on the equal probability of committing any given error and its equal in the opposite direction. This premise is only approximately true with gun fire and especially with errors in the range direction, as will become apparent if we consider that many of the errors are made in small angles at the gun itself; and the effect of a downward angle is not the same in diminishing range as that of an equal upward angle in increasing it; nor have decreases in muzzle velocity the same value in decreasing range as have equal increases in velocity in the opposite direction. The application of the theory of errors then to gun fire can only be approximate. It is or should be presumed that a spotter of any capacity will in the long run have his mean point of impact on the target point of aim.* From this target, then, as projected on the sea along the line of fall of projectiles, equally probable range errors will be practically equal, long or short. The extreme range error, long or short, will be about three times the mean range error (or average of all range errors), and for practical purposes may be taken three

* It may eventually be demonstrated that due to the method of spotting a certain spotter averages a certain amount short or long. This should be applied as a permanent correction to his ranges.

times exactly. The proportion is equally true for any kind of errors—vertical, lateral, radial, or absolute, made by projectiles fired under the existing or any chosen conditions. It is of course not true for wild, trembling, accidental, or random shots, or for shots fired under conditions of a different kind.

There are a multitude of causes of error in gun fire, but whatever the separate mean errors due to the various causes may be, the most probable value of the combined mean error will be the square root of the sum of the squares of these separate mean errors (following the theory of errors) and the chance of hitting will be diminished according to the same theory as the final mean error is increased. This, it should be understood, is in the long run. One great dispersion may at times accomplish a hit where a short dispersion could not with the same mean point of impact (not the target) for the salvo, but it can work a miss equally well where a short dispersion would get two shots in the target.

A shot-gun is a weapon that fires a great number of projectiles in a short time. Any one of these minor projectiles will suffice for the bird or object ordinarily fired at, and the endeavor is to cover the space in which the bird or object may be. There is no method of correction for successive shots, as it is not possible to determine by sight where most of the shots have gone. Two bodies moving in the same portion of space are the more apt to collide as their sizes or that of either is increased, and in the shot-gun the working size of the projectile, taking all with spaces as one projectile, is increased to a limit where it is considerably greater than that of the target. But if the desire were to hit the bird or object as often as possible with individual projectiles, and if hits could be noted on a larger target around such object, it is sufficiently apparent that a much greater number of hits could be gotten by successive shots with an accurate weapon than by the same number of projectiles fired from a shot-gun; as, for example, by the use of a gallery rifle at a mark on a target at shot-gun ranges. And do the best we can with gun and instruments, due to the outside influences such as fluctuations in atmospheric refraction, in strength of wind, in barometric pressure, with holes in the air, variations in temperature of charge and gun, varying vibratory droops or rises of gun-muzzle, varying spring or jump for different mounts or for the same mount with different training, varying uncompensated vertical angles of axis of elevation of gun, etc., *there will always be relatively to a ship-target more than sufficient similarity to a shot-gun dispersion with even our best salvos.* If we are considering only one salvo or are not going to, or cannot, spot at all, and the range finder is not adjusted to the gun by a known mean correction for the range used and under the prevailing conditions, it would, without doubt, be better to waste a certain amount of ammunition by throwing in an intentional controllable dispersion by simply firing the guns with varying range settings covering the probable range error. This would simulate a good shot-gun, but if continued would make for very primitive target practice. It is a method adapted to an unlimited supply of ammunition and corresponding capacity of weapon to use it, and is especially available for small arms and with the battle conditions of land forces.

The line of advance for larger guns seems always to point in the direction of precision with men, instruments, implements and methods. Controllable dispersion has a value under certain circumstances, not inconsistent with precision in method. But great dispersions, if not worked according to a progressive system with sights set as regularly increasing increments and with guns fired in succession, put the spotter entirely in the air. In short, large gun errors make large spotter errors, and ships that are trying to make records choose every favorable condition, calm, clearness, uniform temperature of magazines, etc., with a view to reducing every mean error due to any of the numerous causes as much as possible, well knowing that their various poor scores have been due to a failure to overcome some one or more of these embarrassing conditions in the past. *Errors, reduce them as we may, are altogether too large, and everything possible should be done to eliminate them.* It is no more necessary to separate the spotter error from the gun error proper than it is to separate the refraction or other types of error, and with the accurate methods of recording now beginning, it may soon be practicable to differentiate the one as well as the others, down to a point where the spotter and the pointer and other persons involved with various causes of error could be intelligently marked as to qualification for the posts they thus occupy, as well, we might add, as could the accuracy of the gun unit itself, in the state at which it has at length arrived through increasing age and use.

LIEUT.-COMMANDER RIDLEY MCLEAN, U. S. Navy.—I find this a most difficult paper to discuss, on account of the fact that it arrives at no final conclusion, which has a practical bearing on gunnery training.

The paper, if read casually, especially by the many young officers in the service who have given the question little thought, might readily be construed into a mathematical demonstration that dispersion in gunnery was a good thing and that in *practical gunnery training* it was not necessary to reduce dispersion to the *minimum limits possible.*

If this academic discussion of the relation between fire control errors and dispersion errors is to have this effect, the paper is pernicious and inimical to practical gunnery training in the navy.

A popular novel a few years ago demonstrated that for certain reasons a certain number of fleas were good for a dog, but still the average dog, despite all possible care, has a sufficient number for the purpose; so also in practical gunnery, I feel that, strive as hard and as intelligently as we may, we shall always find that we have more dispersion than we want, and any treatise or paper, however correct may be its mathematics, which leads the service to regard dispersion with equanimity—in fact which leads us to regard dispersion in any other light than as the very greatest enemy to efficient gunnery—cannot but have a bad effect.

Lieutenant Long concludes that fire control errors must be reduced to the minimum possible, and states that then "it will be apparent at once whether dispersion is too small or too great to insure the greatest number of hits."

Academically this statement is true; practically it is not true, because we can never arrive at a point where we can say that fire control errors have

been reduced to the mathematical minimum. Fire control errors vary so much with the spotters, with the range finders, with the condition of spotting glasses, with atmospheric conditions, and with dispersion itself, that it seems utopian to state that we can ever arrive at such a state of training throughout the service as to justify us in stopping to consider whether or not our dispersion is too small.

This paper states that an examination of the Atlantic fleet records for 1911 and 1912 shows that, maintaining the *same fire control errors*, the hitting would have been increased by increasing the dispersion.

It is presumed that this statement is correct, yet it in no wise follows that dispersion ought to have been greater—it simply proves that fire control errors should have been less.

In deciding whether or not dispersion should ever be increased, let us not be led too far by purely mathematical deductions. Let us rather consider what we are striving to attain. The mathematics of the paper has merely demonstrated that for a given error in fire control, E, there must be a certain dispersion, D, to give the maximum number of hits, but as the paper itself states that all of our energies should be expended to reduce E to zero and when E becomes zero D must also become zero, it would follow that similar efforts should be made to reduce the dispersion error to a minimum.

So much for the mathematics involved. But let us consider an actual target, range 10,000 yards, salvos of seven 12-inch, 2850 f. s. shots being fired at it, and let us disregard all lateral errors and assume that in each salvo the dispersion between different shots is uniform. Certainly the *maximum* results can only be obtained when the shots are well bunched and when the center of impact coincides with the center of the target. A mean vertical dispersion of about 8 feet under such conditions, which would make the salvo cover a zone about 105 yards wide, would land all shots on a target 30 feet high. A mean vertical dispersion of 13 feet, corresponding to a width of zone of about 160 yards would render four, the greatest possible number of hits. A mean dispersion of 26 feet vertically would result in only one hit if center of impact coincided with center of target, two hits if slightly displaced one way or the other.

Two hits would thus be a *maximum possible* score with a mean dispersion of 26 feet, which corresponds to a zone about 312 yards wide; one hit is the maximum possible for any mean vertical dispersion in excess of 50 feet, which corresponds to a zone 625 yards wide.

Under these conditions it doesn't matter within the width of this zone where the target is, it will get one hit and no more, assuming the salvo is correctly aligned. With more than 50 feet mean vertical dispersion the target may be straddled, but you may or may not make a hit.

Now, it is perfectly true that when a material fire control error exists, dispersion is necessary to obtain a hit, which is to say, that a perfectly bunched salvo which for any reason falls short or over, will make no hits at all, whereas if these shots were dispersed sufficiently one or possibly even two hits might be made; also it is perfectly true that with a considerable dispersion, fire control errors within the limits of that dispersion will not affect the score; but it is fallacious to use either of these facts as an argu-

ment in favor of dispersion, for the simple reason that gunnery training must be based on a system which leads to a high score, and a high score with any material dispersion is mathematically impossible.

If we remember that two hits on a 30 foot target is the maximum possible score when the shots are uniformly dispersed through a zone 300 yards wide (which at 10,000 yards range is not in any sense a wide dispersion), and one hit the maximum possible when the shots cover a zone 600 yards wide, and that neither one hit nor even two hits out of a salvo of seven shots can be considered sufficiently high a score to be considered a goal, it follows that every effort should be made to reduce dispersion to the smallest possible limit, and consequently we must reduce our fire control errors so that we can utilize the greatest accuracy of fire that it is possible for us to attain. Any other method is false training.

It may readily be shown that under certain conditions a greater number of hits would have been obtained by increasing the dispersion, *but it can never be shown that a really high score could ever be obtained in that manner.* Dispersion absolutely precludes a high average score, and though it may render a low average almost certain, it must be remembered that low averages won't win battles.

LIEUT.-COMMANDER T. T. CRAVEN, U. S. Navy.—In considering the question under discussion, which involves practical long range firing from a ship, one is impressed with the lack of accurate data on which to base conclusions.

The methods which have been in vogue for ascertaining the amounts by which the targets have been *missed* at target practice, together with the reliability of these data as a basis for precise argument, are probably well understood.

In his discussion of the "Accuracy and Probability of Gun Fire," page 134, Article 140, Exterior Ballistics, the late Professor Alger makes the following statements:

"Evidently the less the mean errors of a gun the more important it is to accurately regulate its fire; if the distance of the mean point of impact from the target is more than three times the mean error of the gun, there will be practically no hits at all.

". . . . Thus we see that a gun may be severely handicapped by its own accuracy if the range is not known within 10 per cent."

The truth of the opening statement contained in the first paragraph requires no elucidation. That in the second paragraph is shown to be correct in the deductions that precede it.

Lieutenant Schuyler aptly closes his well-written notes on this same subject in Volume 37, No. 3, Whole No. 139, of the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, with the statement that " . . . . their importance seems to justify the systematic collection of data and further study."

We have seen the range constantly and rapidly increase within the last few years and this is primarily because the so-called fire control errors have been steadily reduced. The 10 per cent error considered by Professor Alger in 1904, when 5000 yards was thought to be a long range, would be regarded as excessive to-day at double that distance.

There has been a corresponding improvement in all of the methods of long range control and a decrease of the dispersions incident to materiel has also been accomplished.

The advances that have resulted in heavy guns becoming weapons of precision have permitted the successful control of fire at long range. Any improvement in the accuracy of the guns, which results in a further decrease in dispersion, will bring about a corresponding improvement in the facility of control afloat and an increase in hitting power.

The fact that the performance of the gun has directly to do with fire control, and perhaps the establishment of the range, must not be overlooked. While it is manifest that the errors of gun fire are due to a variety of causes, it is also evident that the fire control officer afloat has to deal with the summation of all the parts of which it is composed, *i. e.*, the whole error.

A reduction in any one of the composing parts reduces the whole error and constant, systematic, and continued effort must be directed toward searching out and eliminating such of these parts as may be reduced or eliminated.

With accurate guns, dispersion can be regulated at will. Without accurate weapons as well as accurate instruments and methods of fire control accurate gunnery is impossible.

The author has, after a considerable discussion, arrived at the crux of his argument in the self-evident, well-understood conclusions that—

"In order to assist the spotter there must be the least possible dispersion," and "when everything possible has been done to reduce fire control errors, and dispersion has been kept as small as possible, target practice firing will show what range and deflection errors are obtained. These firings will also give the dispersion of salvos, and it will be apparent at once whether the dispersion is too small or too great to insure the greatest number of hits."

LIEUTENANT W. R. VAN AUKEN, U. S. Navy.—The article by Lieutenant Long on "Dispersion and Accuracy of Fire" is a most timely one. At present, ships are not getting the percentage of hits at long ranges which *are*, and *must* be expected. An *Arkansas* or *Wyoming* not hitting at long ranges is not to be feared by a *Michigan* whose guns are hitting. It is most important now to consider how to increase the hitting efficiency of new ships, for no type of battleship of the largest displacement and guns is superior to older ships in gun fire unless the weight of metal hitting is a fair percentage of that thrown from the firing ship on each broadside.

From results of firing where spotters have controlled the fire, it seems impossible to get the mean point of impact of salvos nearer than 150 yards to the center of danger space. In such salvos, the average mean dispersion was about 50 yards. Now, from a consideration of this article and that by Ensign Schuyler on "Dispersion in Salvos," published in September, 1911, it is granted to be true that the mean vertical dispersion to attain a maximum percentage of hits at any range or target should be equal to 4/5 or 80 per cent of the distance of the mean point of impact from the center of the danger space. If many salvos are fired, where there are vertical dis-

persion and fire control errors it is admitted this relation will hold true. In battle where an enemy's ship is 500 to 600 feet in length, lateral dispersion will cause few, if any, misses. In theory and practice, this mean lateral dispersion is about equal to the mean vertical dispersion at long ranges. So under battle conditions, only mean vertical dispersion need be considered. Hence with the existing fire control error of 150 yards, there should theoretically be about 120 yards mean dispersion to secure the maximum hits. As this is admitted to be at least twice the dispersion that exists now, it is seen that a large percentage of hits are lost.

Though at present, spotters have not materially reduced their errors in controlling salvos of reduced dispersion, the fact remains that we cannot afford to even consider an increase of dispersion beyond that which is brought about by natural and expected gun errors. As dispersion has been reduced somewhat, the fire control efficiency has not kept apace. The materiel seems to be ahead of the fire control training. This reduced dispersion has not as expected reduced the fire control errors.

After reading this article of Lieutenant Long's, one ought not to seriously consider making an increase in dispersion. We cannot afford to be satisfied with the present fire control errors and assume that no improvement can be made at long ranges—through training or by study of the science of gunnery. In bringing about a greater dispersion by any means and working for a scattered salvo in the hope of getting one or two hits by luck, we would convert our modern battery into a large "shot-gun" and sacrifice everything to pure luck. *By all means we should seek for small dispersions and work for reduced errors in control of the fire at long ranges.*

As regards the fire control error it is believed that its principal component is that due to spotting. This statement is based upon the average records of spotters at spotting practice compared with the fire control errors in actual battle practice. This spotting error can be decreased by systematic training and a study of the science of gunnery. It is believed that range finders combined with the spotting will halve the present fire control errors, and with this, a natural mean dispersion of 20 to 30 yards will about agree with the dispersion of theory.

Gun fire at long ranges is based on science, and now, more than ever, all ordnance officers should be conversant with the action of powder, ballistics, probability of hitting and all elements bearing upon the trajectories of projectiles fired at long range. These problems involved in long range control will require deep study and careful investigation. It would seem that a special gunnery ship could be assigned for this duty, and in addition to study carried on aboard, practical experiments could be made at various ranges in spotting, range finding and the limits of long range firing.

It is reasonable to expect that improvement *can* and *will* be made in the control of long range salvos. No haphazard work will bring this about. What is needed is a calibration range, "Gunnery Experts" ship, target practice conducted at long ranges by officers trained on the gunnery ship, a range finder experimental station, and a study of the science of gunnery.

LIEUTENANT G. L. SCHUYLER, U. S. Navy.—It is only comparatively recently that we have begun to awaken to the fact that in view of the im-

possibility of getting the center of impact on the center of the target, what hits we make are not *in spite* of dispersion, but *by virtue* of it. Lieutenant Long's excellent article about winds up the presentation of this side of the argument and it is hoped that familiarity with it and with Ordnance Pamphlet No. 410 will dispel some mistaken ideas on this matter which are only too prevalent in the service at large.

The dispersions now being less than the desired 80 per cent of the fire control errors, those who would further decrease dispersion before fire control errors are further decreased do so with a mathematical certainty that they will, on the average, fare worse than now.

There are in the service many officers who will ignore the entire argument because, on the face of it, it does not seem proper that the pointers who aim most carefully should be poorest rewarded in hitting. In a way, it almost offends our sense of right and wrong to see carelessness apparently rewarded. It should not be, we say. But sentimental reasons will not stand against mathematical ones.

For the benefit of those who would believe it if it all did not sound like such rank heresy and opposed to what they have grown to believe almost religiously, it should be stated that the idea is *not at all* novel in small arm fire at long ranges. Perhaps when they find it a perfectly established and well-recognized fact in small arm fire, they can begin, perhaps grudgingly, to admit there may be something in it after all.

"The Rifle in War," by Captain Eames, U. S. A., is interesting reading in this connection and it is instructive to read of what is called the "combined sight." This means, usually, that the front rank and rear rank set sights at different ranges to increase dispersion, to make it bear a more favorable relation to the probable error in estimating the range of the object. When the dispersion is properly increased more hits are expected. When we get to know of this principle in small arm fire, maybe we can with less distrust listen to those who claim it is just the same with naval guns.

Navy Yard Problems.

(See No. 143.)

ASSISTANT NAVAL CONSTRUCTOR C. A. HARRINGTON, U. S. Navy.—In the September issue of the PROCEEDINGS, Assistant Naval Constructor Otterson has contributed some novel ideas relative to navy yards. It is not understood that the author of "Navy Yard Problems" intended to treat all the problems involved in navy yards, because to do so would require many issues of the PROCEEDINGS rather than some twenty pages of one issue, and would probably take all the rest of Mr. Otterson's life (the latter statement being in no wise intended as a reflection on his ability). He, therefore, perhaps intentionally treated some problems "academically" and ignored others entirely, for which he has been rather harshly criticised. In the minds of some, the chief fault with Mr. Otterson's essay seems to be that he forgot to mention that "navy yards exist for the fleet," a statement which, of course, is quite necessary in any discussion of our navy yards. As the criticisms contained under "Discussion" in PROCEEDINGS No. 143

failed to bring out what appears to the writer to be misstatements and false logic in Mr. Otterson's essay, and as it does not seem quite right that these points should be allowed to pass unchallenged, the following ideas are submitted:

The navy yard problems which are discussed by Mr. Otterson are: (1) a proposed method of treating alterations; (2) the number of navy yards; (3) competition in manufacture among navy yards.

Alterations: The routine suggested by Mr. Otterson is considered advisable for important alterations. If the alteration requested by a single ship is considered of sufficient importance in the discretion of the divisional commander, the matter could be referred to ships of a division and then to ships of the fleet, the result being that if really important, general authority for the change would be issued by the bureau concerned or the department. In this manner, data for future designs would also be on file. It is, however, noteworthy that fully 40 per cent of the items on page 863, these being the most important items also, are alterations which have been authorized in general letters from the bureau concerned. A good many alterations requested by ships are either insignificant in character or of a local nature, which statement is also borne out by a review of the items tabulated on page 863. From these two facts, therefore, it would seem that the items listed by the author fall practically into two classes, namely: (1) those of sufficient importance that the need for the alteration is recognized by the bureau concerned, and general authority is accordingly issued; (2) alterations of local nature or unimportant in character. The routine suggested by Mr. Otterson would, therefore, be necessary on exceptional occasions.

Number of navy yards: Mr. Otterson has ably pointed out the disadvantages of consolidation of navy yards. A single navy yard is operated on the basis that whenever economical and military policies clash, the military policy is retained. The consideration of "sound strategy" and the "pork barrel" and the hunt of the office for the man or vice versa should not be introduced to befog a principle which we use so often these days. One navy yard on the Atlantic Coast would undoubtedly be more economical than five, but as it is obviously an unmilitary policy, as Mr. Otterson proves beyond the shadow of a doubt, why do we advocate it? The policy of carrying "all our eggs in one basket" is not quite as serious as the author makes out, as in time of war repairs to our ships could be effected by private ship yards in addition to our one supposed navy yard. If the repairs to our ships required docking, however, as they probably would, the situation is exactly the one that Mr. Otterson describes, as private yards in this case cannot help us, as only one of the private shipyards on this coast possesses a dry dock.

As an industrial undertaking, the founding of one large yard to do the work of our present yards on the Atlantic Coast is not what might be called a difficult problem in the light of modern engineering. It is easy to conceive that, with our present knowledge, one large plant might be built which would in a comparatively short time pay for itself, provided a proper location were secured. One of the requirements of a proper location is close proximity to a labor market which offers mechanics of all the varied

trades. This requirement positively means the establishment of such a navy yard on this coast in the vicinity of New York, Philadelphia, or Boston. Manufacturing plants frequently build up a city because they offer steady employment. This is not the case with navy yard work, and good mechanics would not build homes and locate their families any place on the shores of Narragansett Bay with the prospect of fluctuating work in a large nearby navy yard. Much more might be said against the establishment of one large navy yard on the Atlantic Coast, but no stronger arguments are needed than those which Mr. Otterson has brought forth.

Distribution of work to our navy yards: The proposal which Mr. Otterson offers bears a striking resemblance to a protective tariff protecting the infant industries. As a matter of fact, Mr. Otterson is pleading for the old method whereby each yard manufactured various articles of equipage in quantities proportional to the demand at that yard, this demand being of course dependent on the number of ships assigned to the yard for repairs, which is the condition recommended by the author (see top of page 872) for determining the factor assignable to each yard to be used in distributing manufacture work. For example, before the manufacture of hammocks was concentrated at certain yards, the New York yard probably manufactured all the hammocks required by ships domiciling at that yard; in the proposed distribution of hammock manufacture, New York would get say 40 per cent of the work on account of the number of ships assigned to the New York yard. There is accordingly nothing new in the proposition.

It does not seem that the author presents any arguments tending to disqualify competition among navy yards in the manufacture of certain articles of equipage; as a matter of fact, it would seem that he has at times jumped to conclusions which are not justified even by assumed premises, namely, when he states at the top of page 871, "so it appears . . . . at a critical time." Such conclusion does not appear to be justified by the statements immediately preceding it.

As to the method or basis of making competitive awards (see page 871), it is understood by the writer that awards are not made wholly on the basis of competitive bids, but that past performances (comparison of returned costs by the bureau involved) are also very largely considered. The writer does not believe that excessively low estimates are intentionally submitted, as each yard knows, if the contract be secured, that it must make good or stand a chance of losing the business.

On pages 872 and 873, the author gives an example of the working of his proposed system and also a hypothetical case of competition. Publishing bulletins containing comparison of returned cost of manufacture and directing investigations would not standardize the efficiencies of the various yards, as there would always be "a least efficient" yard. Some yards have better machinery than others, are better equipped with dies and other expensive labor saving devices. For example, in making drop forgings, would all yards be provided with a set of dies as good as those at Norfolk, or would Norfolk lead in the manufacture of drop forgings and the other yards trail along as best they could?

The competitive system of bidding for manufacturing work has now

been in actual practice some time, and up to date no yard has secured a monopoly of any line of manufacture. The practical result has been that manufacturing work has been distributed, one yard making ditty boxes, another yard boat chests, a third yard boat hooks, etc. Actual conditions, therefore, are quite different from Mr. Otterson's theoretical conditions. There is a great stimulus to this sort of competition, because if a manager at one yard sees, for example, that other yards are getting most of the wood work manufacturing, he knows that there is something wrong with his joiner shop and will proceed to investigate it very thoroughly. The object of every efficient manager is to secure the manufacture of certain articles of equipage which will help him in maintaining his force when there is not sufficient ship repair work. Unfortunately there is not sufficient manufacture work at present so that a steady force can be given employment. There is, however, enough manufacturing at some yards so that the best mechanics may be retained when there is a dearth of ship repair work.

On page 872, Mr. Otterson says that in comparing costs, direct labor is "the true basis of comparison." The true basis of comparison should be the total cost, consisting of labor, indirect, and material. If any other method is used in comparing costs of different yards, a false conclusion is likely to result on account of the following reasons:

(1) Owing to the looseness of the present accounting system, labor which at some yards is charged on the job as "direct labor" is charged at other yards as "indirect." At some yards, for instance, mill work on boats is charged to shop expense and enters into the cost of the boat as "indirect." Therefore, if direct labor only were considered in comparing the costs of boats made at different yards, those yards which charge mill work as indirect would appear to advantage.

(2) The indirect should be considered for the reason given under (1). Also, a number of shops have shop planners whose labor is charged in the overhead expense of the shop. Planning tends to lower the direct labor cost and to increase the "indirect." If "indirect" is not considered, a shop with a large number of planners would undoubtedly show less direct labor cost on a given article than would a shop with a less number of planners.

(3) "Material" cost should be considered because, as Mr. Otterson says, we desire only the "necessary" quality. Some yards would, for example, use a higher grade of pine than was necessary in the manufacture of certain parts of furniture, some yards make breaker stands of ash while others would make them of cheaper beech, birch or maple. Is it fair that a manager who can reduce costs in such a way should fail to receive any reward simply because a comparison of "direct labor" only is to be made? If such were the case, the temptation would be to use only the very best material, as it is a well-known fact that good material reduces direct labor cost.

Comparison of costs on the basis of direct labor would, to say the least, be elusive, as would be also the comparison of estimates based upon direct labor only.

Severe exception may be taken to the author's logic exhibited in the last paragraph on page 878, as there is not the slightest analogy between the best

ship at target practice and the best shop at manufacturing. This the author admits, when he says, "It is no more logical to award the work to our navy yards on the competitive basis than to award the allowance of ammunition to our ships on the basis of which made the most hits at the last target practice." The author then proceeds to make the absurd statement that "the ship that makes the most hits this year will do all the firing next year," with the intention, I presume, to have the careless reader think that it is equally absurd that "the shop that does the cheapest work this year will do all the work next year." Suppose we assume a certain similarity between the ship and the shop and endeavor to make a *rational* statement about the former and apply this statement analogously to the latter. We would then say, "The ship that makes the most 6-pdr. hits this year will be excused from firing 6-prds. next year." "The shop that makes the best and cheapest ditty boxes this year will be excused from making ditty boxes next year." The foregoing analogy is certainly as sound as Mr. Otterson's, but both of course are absurd.

Competition among navy yards in manufacturing has resulted in a considerable saving of money on account of the fact that the cost is very greatly decreased. This competition may be greatly extended, so that competition will exist not only among navy yards, but between navy yards and private contractors. The amount of money that can be saved to the government yearly by competition alone is considerable. This will be apparent to any one who investigates the cost of various articles in the custody of the General Storekeeper which have been purchased from outside contractors. We have made a little headway in manufacturing in our navy yards due to competition, but the field is yet practically unexplored. We need fear no loss in efficiency such as Mr. Otterson has described due to competition. From observations of a personal nature, I am of the opinion that what little competition we have had has resulted in increased efficiency in some yards, increased stimulation on the part of those in charge, better designs, and better quality of articles manufactured. In certain lines of manufacture, it is found cheaper to keep machines and mills operating, even though the product is sold at a loss, rather than to shut down entirely. In the navy, we do the opposite thing; that is, we shut down a shop or, practically the same thing, run it on very much reduced capacity at the slightest provocation. Why? The answer partly is that we have not yet made a dent in navy yard manufacturing. The subject of navy yard manufacturing and competition therein is worthy of minute and exhaustive study.

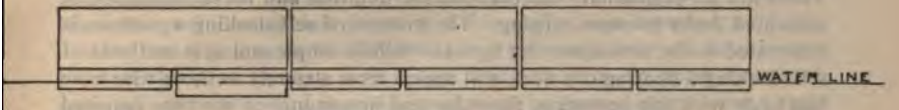
An Improvement in Floating Dry Docks.

(See Nos. 142 and 143.)

CIVIL ENGINEER A. C. CUNNINGHAM, U. S. Navy.—*A Review of Preceding Discussions.*—Those who have had to do with the self-docking of floating dry docks will most fully appreciate the importance of simple and safe methods. In some methods careful calculations must be made beforehand of the flotation of the separated parts, and the interior water levels must be adjusted accordingly in order that there may be no shearing of bolts and

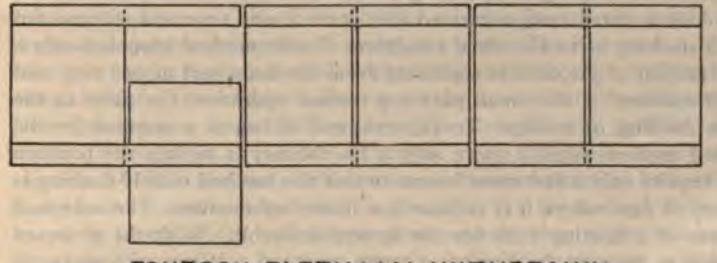
PROCESS OF DOCKING

ELEVATION



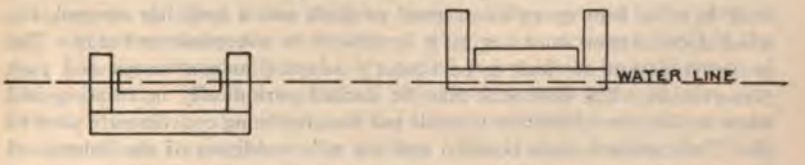
PONTOON DETACHED AND BALANCE OF DOCK PUMPED UP LEAVING PONTOON FLOATING FREE.

PLAN



PONTOON PARTIALLY WITHDRAWN

END VIEWS



PONTOON IN POSITION READY FOR SELF-DOCKING, AND PONTOON SELF-DOCKED.

pins as the connections are opened. At each self-docking these calculations must be repeated as the interior water levels will vary with the accumulations of growth and sediment on the interior and exterior of the dock. In other methods the submergence of decks of separated parts, acting as water planes, will cause surging that is troublesome and may be dangerous. In the design under discussion all of this has been overcome. A pontoon being disconnected, the balance of the dock is slightly pumped up and the pontoon floats free, after which it is regularly docked on the balance of the dock. There are no preliminary calculations for flotation and no submergence of separated decks to cause surging. The process of self-docking a pontoon is illustrated in the accompanying figures. While simple and safe methods of self-docking a floating dry dock will appeal most strongly to those who have had to do with this operation, the value and importance of the time required will appeal with equal force to every one. It is of the very greatest importance both from a commercial and a military standpoint that self-docking should take as short a period as possible. If self-docking requires a long time it may result in the interruption of business and the loss of work, or it may mean the temporary or permanent loss of a battleship, or the lowering of the efficiency of a fleet from loss of speed due to lack of cleaning foul bottoms. Most methods of self-docking require from two to three months at the least for cleaning and painting alone. This is due to the fact that the entire dock is extensively separated into parts at one time and reconnected for self-docking in an abnormal condition. In the method proposed only a small fraction of the dock is separated from the main part at one time and the self-docking of this small part is a normal operation, the same as the regular docking of a ship. To separate and self-dock a pontoon by the proposed method would require only a few hours; to replace the pontoon would require only a few more hours, so that this method of self-docking is a matter of days where it is ordinarily a matter of months. The continual readiness of a floating dock for use is very desirable. With the proposed type this is secured by having a spare pontoon. When a pontoon is detached for self-docking, the extra pontoon is put in its place and the dock is then ready for its full function. With a spare pontoon the dock need not be out of working order more than six hours at the most. Those who have been directly concerned with floating dry docks fully appreciate that continuous and careful preservation is of the utmost importance if the dock is to be kept up to its original strength and a long life insured, for when deterioration once begins it is difficult to overcome and stop. The proposed design of dock is particularly adapted to continuous and easy preservation. The pontoons may be docked periodically in rotation and when docked are in the best possible position for being conveniently worked on. Their entirely safe position and the safe condition of the balance of the dock does away with any necessity of undue haste. The ease and quickness of self-docking a pontoon also makes it possible to self-dock for inspection alone, an operation which is prohibitive with a dock that requires from one to two months to self-dock. The design of this proposed dock as a weight-carrying structure is perfectly simple and definite and is the equivalent of a plate girder bridge with its floor beams. The longitudinal

stresses are definitely carried by the side walls and the transverse stresses by the pontoons. In designing a floating dry dock it is frequently the case that some longitudinal stiffness is credited to the pontoon portion; as the most of the weight is received by the central bulkhead and as this is a girder in the general proportion of six hundred feet of length to twenty feet of depth, it is evident that without excessive weight in the central bulkhead its resistance to bending is slight, especially in the early stages of deflection. The entire absence of longitudinal stiffness in the original sectional docks that had no rigid connections whatever between the sections has left a prejudice against joints in a side wall. It is, however, perfectly evident that a joint can be designed for a side wall that will be stronger than the body of the side wall itself, and this with no great excess of material. Where a joint in a side wall must be opened every time a self-docking is undertaken, there is naturally a tendency to make the connections as few as possible consistent with safety. In the proposed design the side wall joints are not opened in regular self-docking and from that point of view might be omitted entirely. The joints are to permit the separation and extension of the dock when separation or extension may become desirable, and being for this purpose alone may readily be made stronger than the body of the side walls without in any manner retarding the self-docking process. By making the side wall joints at least as strong as the body of the side wall it makes no difference whether a joint comes at the center of the dock or elsewhere during the docking of a ship. The importance of being able to expand a floating dock in dimensions, and especially in lifting power alone, is best illustrated by reference to the government floating docks at New Orleans and in the Philippines. The New Orleans dock is rated at fifteen thousand tons, and the Philippine dock at sixteen thousand tons capacity. Within six and twelve years of their completion both of these docks have become too small in lifting capacity for the modern ships of the navy. In length, width, and submergence capacity they might still be used, but their lifting power has been greatly exceeded by modern war vessels and there is no way of increasing it. In the proposed type the increase of lifting power by substituting deeper or longer pontoons is as simple and economical a way as could be devised, and the actual substitution would take no longer than a self-docking. The lifting capacity of a floating dry dock can not be increased by placing low bulkheads across the ends and covering the openings in the deck to form a shallow pound to be pumped out, without straining the dock beyond what it was designed for. If the dock is designed originally for such a pound, it would not be an increase of lifting capacity. There are practical objections to such a pound, also, one of which would be the surging of the large unconfined body of water as the pound was coming above the surface. The Havana floating dry dock, later known as the Pensacola dock, was actually designed and constructed for a pound on the deck, and was called a combined floating and graving dry dock. Instead of bulkheads at the ends, which would have to be higher than the blocking to be of any use, it had low caissons that were to be seated as the dock came up. It was found in practice that the rush of water off the deck as the dock came up made it impossible to seat the

caissons in their grooves and they were never used. Expansibility of a floating dock in dimensions is of more importance from a commercial point of view than from a military point. For a full return on the investment a commercial dock must be generally worked to nearly its full capacity. This means that it should not be designed for much beyond the average ship that visits its port. If, however, the dock is so designed that its dimensions can be increased, the gradual increase of the average ship is readily taken care of. It may also be possible that capital is available for a dock of small dimensions, but not for a large one; if the small dock is of an expansible type it may be increased in size with its own earnings. The maximum possible ship that may visit a port can not be taken into account by the ordinary commercial dock unless the ship is a regular patron; two average expansible docks of the same type, however, can be readily coupled up to handle such cases to advantage, while ordinarily the two docks are both in use for the average business. In an expansible dock it is an advantage to have each section fitted with its own pumping machinery. When so fitted the operating power is always correctly proportioned when the dock is either separated or expanded. Furthermore, it makes the power elastic and the chances of complete failure of operation from a break-down are greatly reduced. In this proposed type of self-docking steel floating dry dock, the peculiarities and deficiencies of preceding types have been considered and avoided as much as possible, and the object has been to secure the following results: A dock that can be continuously preserved with the least time, trouble, danger and expense. One that can be readily, quickly and economically expanded through long periods to meet seen and unforseen conditions. One that admits of separation before or after expansion. One that can be quickly and economically built in any location. One that can be towed from one locality to another without extraordinary preparations or facilities.

PROFESSIONAL NOTES.

Prepared by LIEUT.-COMMANDER RALPH EARLE, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINE REPUBLIC.

VESSELS BUILDING.

Name	Displacement	Speed.	Armament	Builders	Remarks
Battleships					
Rivadavia.....	28,000	22.5	12 12-in., 12 6-in.	Fore River Co.	Launched Aug. 26, 1911.
Moreno.....	28,000	22.5	same	New York Co.	" Sept. 28, 1911.

The Senate has voted by 15 to 14 votes to construct a third *Dreadnought*. This was voted in spite of the opposition of the Ministers of Foreign Affairs and Finance.

The completion of the two *Dreadnoughts* under construction in the United States is awaited with impatience and much interest by the people.

The Minister of Marine has made known the fact that the total naval needs will not be under 145 million francs, an increase of 5 millions over the last years. One hundred and twenty-five millions of this are for the running expenses of the fleet, the rest forms a supplementary and absolutely necessary budget. First there is need to provide for an increase of 2000 officers, seamen, and engineers, which form the crew of the new battleships and of the twelve new destroyers. And this is but half of what is necessary to put the fleet on a war footing.

AUSTRIA.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Viribus Unitis.	20,010	20	12 12-in., 12 5.9-in.	Trieste.	Commissioned
Tegetthoff.....	20,010	20	same	"	Launched Mar. 21, 1912.
Prinz Eugen..	20,010	20	same	"	Launched Nov. 30, 1912.
VII.....	20,010	20	same	Fiume	Laid down 1912

THE "VIRIBUS UNITIS."—This vessel was commissioned September 26, or 29 months from her laying down.

During the week ending August 24 the trials of the *Viribus Unitis*, Austria's first *Dreadnought*, proceeded without interruption. Private reports, however, confirm professional opinion that the slight excess of weight in the armament in no way detracts from the vessel's steaming power. All

the builders' steam trials have been accomplished, and the official runs over the measured mile. Pending this test no statement as to the speed or power developed has been made. On August 14 the battleship was dry docked at Pola. The gun trials have already been carried out. The trials of her triple turrets were a success mechanically, but the loading rate thus far attained is lower than in case of the two-gun turrets.

In appearance the *Viribus Unitis* is decidedly handsome, if this term be applicable to a modern armor-clad. The two views given herewith were taken from a post card.

The length is 488.7 feet, the beam is 88.5 feet, the displacement is 20,500 tons, and speed will be greater than 22 knots. Battery is twelve 12.2-inch 50-caliber guns, twelve 6-inch and eighteen 2.8-inch guns. Armor belt about 11.5 inches in thickness, protective deck 2.4 inches, turrets 12 inches. There are four under-water tubes, one in bow, one in stern, one on each side. The torpedoes are 20.7 feet long, weighing 2794 pounds, and give at 3280 yards a speed of 40 knots.

She exceeded her designed speed by about three-quarters of a knot. She was designed for 21 knots and on trial made 21.8. She floated but 1.6 inches deeper than intended. Some ships steam better in such circumstances. This was very noticeable in the trials of the German *Nassaus*, which are known to draw a good deal more than the designed draft.

The eight hours trial proved satisfactory, all main and secondary machinery functioned without a hitch. The maneuvering trials were also satisfactory.

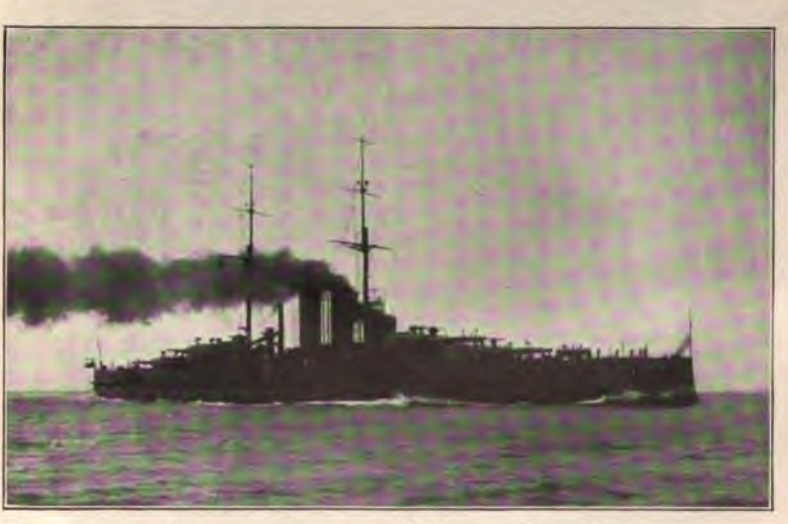
SHIPBUILDING.—The second ship, *Tegetthoff*, is making rapid progress in the fitting-out basin at Trieste. It is understood that all four turrets, with their 12-inch guns, are in position, and work on the superstructures is under way. The third ship (officially designated "Battleship VI") may be launched about the middle of February. A report from Fiume says that the hull of the fourth *Dreadnought* ("Battleship V") is taking shape on the slip, and is due to be launched July 4, 1913.

The three small cruisers of the *Admiral Spaun* type, known as "C," "H," and "J," are to receive respectively the names of *Saida*, *Helgoland*, and *Novara*. The following names have been selected for the six 800-ton destroyers shortly to be launched at Fiume: *Tatra*, *Balaton*, *Gsepel*, *Lika*, *Orjen*, and *Triglav*.

The *Saida* was launched on October 28. Her displacement is 3500 tons, her designed speed is 27 knots, and she will carry seven 4-inch guns, two above-water torpedo-tubes.

At Pola they have commenced building a turbine mine layer of 1000 tons displacement. The three small mine tenders *Dromedar*, *Salamander* and *Basilisk*, of 174 to 314 tons displacement, are too small for efficient service in heavy seas.

BUDGET.—At the concluding session of the Austrian Delegation held at Vienna on October 15, Admiral Count Montecuccoli, the Minister of Marine, promised to lay before the delegates, with as little delay as possible, the new shipbuilding program which he had been authorized to draw up to replace the obsolete Monarch division of battleships. He stated that three battleships of the largest type would be asked for, to be armed with the 45-caliber 13.4-inch B. L., which was recently tested with complete success at the Skoda-Werke. It is understood that each ship will carry a main battery of ten of these guns, disposed in double turrets on the center line, but an alternative plan which has been published in Austria provides for two triple and two double turrets, the disposition resembling that of the United States battleship *Nevada*, the weapons in the triple turrets being locked together for training and firing simultaneously. Protection, both externally and internally, will be given in conformity with the most modern principles.



AUSTRIAN BATTLESHIP "VIRIBUS UNITIS."

FRENCH BATTLESHIP "PARIS."

The first hydroaeroplane received in the Austrian Navy was a biplane of Lohmeier-Daimler type and was tried during August at Pola.

MANEUVERS.—The partial mobilization at Pola will, it is reported be followed by the cruise of an armored division in the Adriatic. All the ships to take part have had their ammunition and provision supplies brought up to the maximum. A torpedo flotilla will accompany the division.

BRAZIL.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleship					
Rio de Janiero,	27,500	22	14 12-in.. 20 6-in.	Elswick	Started Sept., 1911

RIO DE JANEIRO.—This vessel has very light armor for a battleship, 9 inches being maximum thickness. It is 632 feet long, 90 feet beam, and has a designed horsepower of 45,000. Many changes in design have been made, but the vessel should be launched in December.

The Brazilian coast defence battleships *Deodoro* and *Floriano*, designed and built at La Seyne in 1898, are undergoing considerable overhaul at Rio de Janeiro. In place of the original Lagrafet d'Allest boilers, those of the Babcock & Wilcox type are being supplied, and in many other ways the machinery and armament is undergoing extensive overhaul.

The names of the three Brazilian monitors now under construction in this country are the *Javary*, *Madeira* and *Solimoes*. They are of about 1200 tons displacement, and are 265 feet long, 50 feet wide, and 4 feet 6 inches draft. The speed is 11.5 knots.—*The Engineer*.

CHILE.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Almirante Cochrane	27,500	23	10 14-in., 16 6-in.	Elswick	Laid down Nov. 1911.
Almirante Latorre	27,500	23	same	Vickers	" " Dec. 1911.

NAMES OF BATTLESHIPS.—It will be noted that these are changed since last issue. The names given in that issue were those by which they were then known, later they were called *Valparaiso* and *Iquique* tentatively, but on objections by the Chilean press, the names were fixed by a presidential decree as *Almirante Cochrane* and *Almirante Latorre*.

Turbines.—The contract for turbines for these vessels has been given to John Brown & Co., of Clydebank. The shaft horse-power is to be 37,000.

Dimensions.—They displace 28,000 tons, are 661 feet long, 92 feet beam, 28½ feet draft, with a speed of 23½ knots. They are to cost $11,316,839.60. The *Latorre* is to be completed August, 1914, and the *Cochrane* March, 1915. Armament is ten 14-inch, sixteen 6-inch; side armor 9-inch, barbettes 10-inch, and casemates 3-inch.

DESTROYERS.—The first of the six being built in England has been launched. This vessel, the *Tome*, has a displacement of 1850 tons, is driven by Parsons' turbines, and is to make 31 knots. Length is 320 feet, beam 32½ feet, battery of six 4-inch guns, and three 18-inch torpedo-tubes.

FRANCE.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Courbet	23,500	20	12 12-in., 22 5.5-in.	Lorient	Launched Sept. 23, 1911
Jean Bart	23,500	20	same	Brest	" Sept. 22, 1911
France	23,500	20	same	St. Nazaire	Launched Nov. 7, 1912
Paris	23,500	20	same	La Seyne	Launched Sept. 28, 1912
Bretagne	25,000	20	10 13.5-in., 24 5.5-in.	Brest	Laid down May, 1912
Provence	25,000	20	same	Lorient	" " May, 1912
Lorraine	25,000	20	same	Bordeaux	" " Aug. 1912

THE "PARIS."—The launching of the battleship *Paris* at Toulon with unusual ceremony in the presence of the members of the Municipal Council of Paris, had the desired effect of stimulating the popular imagination and creating public interest in the navy. This interest has been growing enormously of late, owing to the confidence inspired by the administration of M. Delcassé, who has worked wonders in the way of creating a navy that can be relied upon in the place of the miscellaneous assortment of ships that had been built by his predecessors.

Constructed by the Chantiers de la Seyne, the *Paris* has only been nine months on the stocks, and this fully justifies the action of the Minister of Marine in having some of the battleships built in private yards, which have beaten the record of the arsenals in the rapidity with which the work has been carried out.

The *Paris* is the third *Dreadnought* of the *Jean Bart* class, and has the same dimensions; that is to say, a length between perpendiculars of 525 feet, beam 86 feet, and draft 28 feet. Its displacement is 23,467 tons. The armament will consist of twelve guns of 12 inches, twenty-two of 5.5 inches, and four 3 pounders.

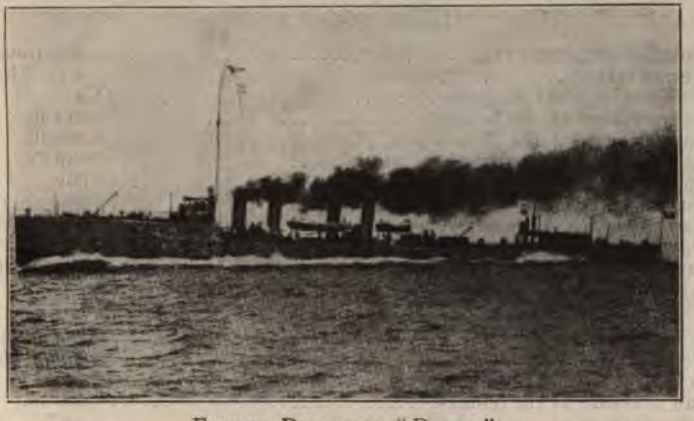
The broadside of this vessel is eight 12.50-inch guns. The secondary battery is composed of twenty-two 5.5-inch 50-caliber guns. There are four 18-inch submerged tubes, all on broadside. The propelling machinery consists of Parsons' turbines driving four screws. The horse-power is 28,605 I. H. P. The boilers are of the Delaunay Belleville type. The armor protection consists of a complete Krupp belt 16 feet 1 inch wide, extending 7 feet 9 inches above water-line, 10.6 inches thick amidships and 7.1 inches at the ends. Turrets are protected by 11.8-inch armor, the barbettes being 11 inches. The battery and main deck amidships is protected by 7.1 inches, the conning-tower by 11.8 inches, the deck on the flat below the armor belt by 2.7 inches, the upper deck by 1.9 inches, and the bases of the funnels by 7.1-inch armor.

Moreover, the *Paris* and *France* have benefited by a series of improvements, which will add to their general efficiency. Their armor is made of special steel, manufactured at St. Chamond on totally new principles, and adopted after a series of comparative tests (at Gâvres) which demonstrated its enormous superiority over Krupp plates, especially against capped shells. This new steel, which contains a high proportion of chrome and nickle, will also compose the defence of the next 27,000-ton quadruple turret super-*Dreadnoughts*.

Some other details of this vessel are worthy of note. There is a specially designed magazine flood system which is centralized, and duplicated, so as to work in action when one lead might be shot away. One series is in the conning-tower, the other on the bridge.

FRENCH DESTROYERS "DAGUE" AND "CIMETERRE."—The French destroyer *Dague* has completed her official trials with good results, and the French Navy is somewhat proud of her success, as she has been completely built according to French drawings. The hull has been designed and built by the Gironde firm; the turbines have been supplied by the Breguet firm according to their own patents; it and the Rateau-Chantiers de Bretagne are the only two builders of French marine turbines under French patents. The boilers are of the "du Temple" type.

The principal dimensions are: Length over all, 255 feet 11 inches; length between perpendiculars, 251 feet 1 inch; extreme breadth, 26 feet 1 inch; breadth at low-water level, 25 feet 10 inches; depth, 16 feet 9 inches; draft astern, 9 feet 8 inches; trial displacement, 730 tons; displacement fully loaded, 770 tons.



FRENCH DESTROYER "DAGUE."

The hull is built of high tensile steel, with longitudinal and cross strengthening, and is divided into 10 water-tight compartments. The vessel has a high freeboard, and forward there is a lofty forecastle, which gives her better seagoing qualities than those of the previous types. The excellence of her lines is shown by the fact that under full power she raises but a small wave, and it is not followed by what is called a "satellite wave." Indeed, the following wave of the *Dague* is of ordinary dimensions, and does not interfere with the speed more than with other similar boats.

Steam is supplied to the main and auxiliary engines by four "du Temple" water-tube boilers operated by liquid fuel—mazout. These boilers have a heating surface of 1920 square meters (=20,667 square feet), the combustion chamber being 14 cubic meters (=494 cubic feet) per boiler. There are 11 Thornycroft burners to each boiler; they deliver the fuel under a pressure of 143 pounds per square inch. Thornycroft fuel heaters are also used. These boilers are designed to work at a pressure of 215 pounds; they are so arranged as to burn 12½ tons of liquid fuel in six hours under full power. The air pressure was to be 160 mm. of water, according to the first drawings.

The main engines consist of two independent sets of Breguet turbines, each of them driving a shaft. In each casing there are an ahead and an

astern turbine. They have been designed to develop an average shaft horse-power of 1500 at a speed of 630 revolutions per minute, the contract speed being 31 knots. The Breguet turbines are of the impulse type, and are mounted on drums. The thrust of the steam acting on the blades is counter-balanced by the propeller thrust. A small thrust bearing takes any difference. Each turbine drives a single three-bladed propeller of 7 feet 1 inch diameter and 6 feet 7 inches pitch. After experiments, this propeller has given far better results than the usual four-bladed one, which will not again be used by the builders on boats of this type. Each turbine has its own independent condenser, having a cooling surface of 5813 square feet (540 square meters).

The fuel is stored in the double bottom and longitudinal tanks on both sides of the boiler rooms. The total capacity is 160 cubic meters (=569 cubic feet). The theoretical radius of action is 2060 miles.

The armament consists of two quick-firing guns of 100 mm. bore, fore and aft, and four 65-mm. guns, together with four 18-inch torpedo-tubes.

RESULTS OF THE OFFICIAL TRIALS.

I.—*Six Hours' Trial.*

Displacement before trial	735 tons
Astern draft	9 ft. 8 in.
Number of boilers at work	4
Mean pressure at the boilers	214 lb.
Mean pressure at the delivery	200 lb.
Mean pressure of fuel at the burners	142 lb.
Mean number of revolutions	667
Contract speed	31 knots
Mean speed for six hours	33.118 knots
Consumption as per contract	12½ tons
Consumption on trials	11.150 tons

II.—*Eight Hours' Consumption Trial at 14 Knots.*

Displacement before trial	734 tons
Astern draft	9 ft. 8 in.
Number of boilers at work	2
Mean pressure at the boilers	200 lb.
Mean pressure at steam chest	49 lb.
Mean pressure of fuel at the burners	58 lb.
Mean number of revolutions	244.16
Speed as per contract	14 knots
Speed on trial	14.3 knots
Consumption per hour	1.031 tons

—*The Engineer.*

The *Bouclier*, of 650 tons displacement, as noted on p. 309 of No. 141 of the PROCEEDINGS, equipped with Normand boilers, attained 35.334 knots on her trial. Contract speed was same as that of the *Dague*. The *Bouclier* is still the speediest destroyer in the French Navy.

SUBMARINES IN THE MEDITERRANEAN MANEUVERS.—The *Moniteur de la Flotte* has the following to say of the work of the submarines in the French Mediterranean maneuvers:

Attack of the 2d squadron at the Ajaccio anchorage (July 19). At dawn, screened by the blockading fleet, the submarines ran submerged in column and passed under the two lines of destroyers on guard, and in succession came to surface in the roadstead . . . . but the enemy was not there. The 2d squadron had forced the blockade in the night; and returned to port about 7 a. m. The submarines again attacked at 11 a. m., and successfully.

Attack of the 2d squadron on route to the eastward from Bonifacio (July 22). The submarines apprised of the departure of the battleships from Bastia and of its general course to the southward, cruised to intercept them 30 miles out on the high sea. Wind was from W. S. W. blowing in heavy squalls, the sea very heavy. *L'Épée* sighted the enemy to northward and the five submarines dived. They did this well in spite of the heavy weather, and succeeded absolutely without being sighted. We note that the destroyers, on account of the heavy sea, could not participate in the maneuvers. After the attack the submarines reached the rendezvous at Lavezzi, and reached Ajaccio the next day.

Attack of the fleet on the high sea to N. E. of Balearic Islands (July 27). The admiral having designated a rendezvous, the flotilla left Ajaccio at 6 p. m. on 26th. The fleet is late. A reconnaisance by the *Épée* and then a successful attack despite the five destroyer flotillas.

Attack of the 1st squadron at anchor in Gulf of Juan (July 29). The 1st squadron is blockaded by the 2d and by the light squadron to which belong the submarines. These took a position in the afternoon near the cruisers 12 miles to sea. They leave, submerging successively, clear successfully the guards of destroyers and attack the battleships. They are not discovered until they rise to the surface.

The flotilla anchored then. The 30th, on account of a violent gale, they took refuge at Cannes, leaving on the 1st and reaching Toulon at the same time as the fleet. Wishing to express his satisfaction at the work of the flotilla, the admiral caused the band to assemble on the *Voltaire's* poop and to play the Marseillaise.

The submarines thus proved that they had a remarkable endurance, they have cruised during the maneuvers more than 800 miles on the surface and 100 miles submerged. Obliged at anchorages to recharge by their own means their accumulators, forced to make numerous trips for matériel, their crew hardly knew the feeling of sleep, and their behavior throughout could not have been better.

There were—it could not be otherwise—some accidents; they were not serious enough to have prevented the submarines from fulfilling their mission in war. The *Cugnot*, with only one motor, took part in the attack off Bonifacio. The *Gay Lusac* had one of its oil engines disabled, but kept on. The *Monge* went ashore at the jetty of St. Tropez and broke her starboard screw, she kept with the flotilla, using one motor both on the surface and submerged.

The tactical results are excellent and are the best proof yet that the building of these vessels of large size and great speed which will form a true submarine fleet is justified.

SUBMARINES IN THE NORTH SEA.—In the Channel the under-water flotillas of Admiral de Marolles successfully attacked the Troisième Escadre off Beachy Head and in mid-Channel, despite the stormy weather, which proved extremely trying to contretorpilleurs, and kept small torpedo-boats in harbor.

Thus these flotillas are not limited to coast and harbor, but it appears they can take the high sea. Admiral Marolles sent this signal concerning the Calais submarines, "very fine results for the submersibles which, in spite of the gale, reached the squadron." On August 4 the flotilla sailed, the anchorage of the battle fleet being known. They reached and attacked the fleet successfully. These submarines had been underway in very heavy weather for 30 hours. Thus the French 400-ton submersibles, blind and slow, are capable of inflicting heavy damage on a division separated from the main fleet or in retreat.

THE "JOULE."—The French submarine *Joule*, 398 tons, with explosion motor, recently cruised a distance of 800 miles without any disturbance of her machinery.—*Marine Rundschau.*

FIRE IN A SUBMARINE.—Fire broke out November 3 on board a French submarine in dock at Cherbourg, as the result of the carelessness of a foreman. All the crew at once left the vessel, and the hatches were closed down. The fire could not spread as the submarine was isolated in a dock and soon burned itself out for lack of air.—*Naval and Military Record.*

TORPEDOES.—The Whitehead torpedo firm are establishing a branch factory in France on the Gulf of the Var.

POWDERS.—Only those with diphenylamine incorporated therein are permitted to be kept on board ship.

During the firing on the *Pothnau*, in the presence of the Ministry, Commander Schwerer was able to produce at will the ignition of the powder gas, and thus reproduce the conditions of the accident on the *Jules-Michelet*. It thus appears that the cause is known. A new system of gas ejection has been developed and gives every indication of being efficient.

PERSONNEL NOTE.—The shortage of men in the French Navy is such that two-fifths of the total required are lacking on battleships of the third squadron, while Admiral Lapeyrere's force is about 1500 men short. The shortage is attributed to the disasters caused by powder explosions, the steps taken to reorganize the men, and the increase of examinations for all ranks. —*Shipping*, Illustrated.

NAVAL POLICY.—The sending of the North Sea squadron of the French Navy to the Mediterranean has left the defence of the coast of the Channel and the Bay of Biscay to destroyers and submarines. Cherbourg has been selected by the French Government as the base for a fleet of twenty-four of the swift craft and a large number of submarines. The destroyers, which will be known as the flotilla squadron of the Channel, will be charged with the defence of the coast between Cherbourg and Havre, and protect such ports of commerce as Calais and Boulogne, Granville, St. Malo, but especially Havre and the mouth of the Seine. With the exception of two submarines, which will be sent to Toulon, all the submarines of the French Navy will remain at Cherbourg to join the destroyers in either defensive or offensive action in case of war.—*Army and Navy Journal.*

NOVEMBER MANEUVERS.—The grave reproach which naval students have long addressed to the French fleet that it lacked tactical practice as well as chiefs experienced in the handling of squadrons at sea is to-day no longer justified in the presence of the strenuous and realistic war preparation that has prevailed in the Mediterranean ever since the Première and Deuxième Escadres have been united under the strong man of action, which is Admiral de Lapeyrère. As a matter of fact, the armée navale will have seen more training at sea during the present year than it did in several previous years. It has carried out interesting combined maneuvers in the spring and summer, and now, on the arrival of the Troisième Escadre in the Middle Sea, it is to study for the third time the problem of the utilization of gun power, maneuvering ability and speed, in a series of strategic and tactical exercises, to commence in the first days of November. There will be two forces. The Red, under Admiral de Lapeyrère, comprising six *Dantons*, three *Gambettas*, eighteen destroyers, and five submersibles, and having Toulon as its base, will have to seek, find, and destroy separately the two fleets of Blue, viz., the six *Patrie-Suffren*, six destroyers, and four submersibles of Admiral Bellue, based on Bizerta, and the six *Bouvets*, three *Quinets*, six destroyers, and two submersibles of Admiral de Marolles, which will start from Algiers to try and effect a junction with the Bellue squadron. The sea speed to be kept is 18 knots for the armored cruisers, 16 knots for the *Dantons*, 15 knots for the *Patries*, 13 knots for the *Bouvets*, and 20 knots for the destroyers, which represents approxi-

mately the rate of going these divers units can maintain under easy conditions, and will permit the efficiency of the machinery to be thoroughly tested. The "hostilities" are only to commence when Red has reached the southern coast of Sardinia, and a blockade of the Deuxième Escadre, in Bizerta, is not improbable. In any case, the operations off the Tunisian shore will provide ample scope for the action of torpedo-craft.—*Naval and Military Record.*

GERMANY.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks.
Battleships					
Kaiser.....	24,500	21	10 12-in., 14 5.9-in.	Kiel (Kaiserliche)	Commissioned
Friedrich der Grosse	24,500	21	same	Hamburg (Vulkan)	"
Kaiserin.....	24,500	21	same	Kiel (Howaldt)	Launched Nov. 11, 1911
Prince Regent Leopold	24,500	21	same	Germania Works	" Feb. 21, 1912
König Albert..	24,500	21	same	Danzig (Schichau)	" April 27, 1912
Ersatz K. F. Wilhelm	27,000	21	10 14-in. (probably)	Hamburg	Laid down Nov., 1911
Ersatz Weissenburg	27,000	21	same	Bremen	" " Nov., 1911
Ersatz "S"...	27,000	21	same	Wilhelmshaven	" " July, 1911
Ersatz Brandenburg	27,000	21	No details	Germania	Projected
Cruisers of the Line					
Seydlitz.....	22,600	27	8 12.2-in., 12 3.4-in.	Hamburg	Launched Mar. 30, 1912
Ersatz Kaiserin Augusta	28,000	27	10 12.2-in., 12 6-in.	Dantzig	Building
"K" 1912.....	28,000	27	same	Hamburg	Laid down June, 1911
Protected Cruisers					
Breslau.....	5,000	29	12 4.1-in.	Stettin	Commissioned
Magdeburg....	5,000	29	same	Bremen	"
Stralsund	5,000	29	same	"	Launched Nov. 4, 1911
Strassburg....	5,000	29	....	Wilhelmshaven	Undergoing trials
Ersatz Seeadl'r	5,000	28	....	Germania	Building.
" Geier ..	5,000	28	....	Howaldt	"
" Irene	5,000	28	....	...	...
" P. Wilhelm	5,000	28	....	...	...

THE "KAISER."—On August 28 this vessel became the flagship of the commander-in-chief of the North Sea fleet.

In her official trial trip on September 12 she made an average speed under forced draft of 23 3-5 knots an hour. The course was over a measured mile.

Her length is 564 feet, beam 95 feet, draft 27 feet. This is the first of the German battleships to be equipped with turbines. These are of the Parsons' type and the vessel has Schultz boilers. Her bunker capacity is 3543 tons.

THE "FRIEDRICH DER GROSSE."—The new battleship *Friedrich der Grosse*, which has been chosen as the flagship of the high sea fleet, anchored recently off Cuxhaven, her appearance attracting a crowd of spectators. In spite of the massive armor which is known to protect this vessel, she looks surprisingly light afloat and quite graceful. The 5.9-inch quick-firing casemates are well above the water, but from their position it would appear that the accommodation for the gunners is very cramped. The conning-tower is a peculiar-looking structure of two stories, the lower one being larger than the average charthouse. No doubt the upper story, which is

small and placed well abaft, constitutes the central fire-control station. At present the masts are without fire controls, but these are to be fitted at once. The amidship turrets en échelon have notably clear training arcs, the absence of intervening superstructure giving them a clear field. The smaller guns are mounted at the same level as the stern 12-inch turret, and should be workable in a heavy sea. Between the fore and after turrets the upper armor strake runs flush with the main deck, and is unpierced by a single port or break of any kind. As far as external observation goes, the greater portion of the hull of this vessel should be invulnerable to the attack of all save the heaviest projectiles. Top-hammer has been cut down to a minimum, leaving but little surface exposed to light high explosive shells. The funnel bases are protected by armored screens of characteristic design, the object of which is to cause the bursting of any projectile before it can penetrate the funnel itself. On the whole, the main features of this ship—the second of the *Kaiser* class of five units—while they have no great claim to originality, give evidence of the most careful consideration on the part of the designers.

The first steam trials of the *Friedrich der Grosse* were carried out in very boisterous weather, as were also the preliminary gun trials, and it is known that she proved herself a steady ship. It may not be known commonly that all German armored ships built since the opening of the *Dreadnought* era are equipped with Frahm anti-rolling tanks. The first ship to be so fitted was the armored cruiser *Scharnhorst*, built at the yard of Blohm & Voss, of which firm the inventor, Dr. Frahm, is a member. Notwithstanding that the tanks then installed were of somewhat primitive design, they demonstrated their efficacy to the complete satisfaction of the authorities, and possibly they have something to do with the accurate shooting for which this vessel is noted. Tanks were next furnished for the cruiser *Blücher*—another famous gunnery ship—and the group of *Nassaus*, and, indeed, for all subsequent ships. It transpires that the cruise of the *Elsass* and *Blücher* to the Faroes last spring was as much for the purpose of testing the respective steadiness of the two vessels as gun platforms, the first named having no tanks, as for the prosecution of other gunnery experiments. If, as is claimed in Germany, warships fitted with this invention are much less inclined to roll in heavy weather than warships unprovided with them, it cannot be gainsaid that the tanks confer a valuable tactical advantage, or that a fleet of ships so equipped would be in a position to meet on advantageous terms a rival force the units of which had no similar equipment. It is plain, therefore, that the question is of considerable importance.—*Naval and Military Record.*

SPEEDS OF GERMAN BATTLESHIPS.—The *Kieler Neueste Nachrichten* states that the *Kaiser* has made 23.6 knots as maximum mean speed for her trials over the measured mile. This puts her at the head of the turbine-driven battleships for speed. The speeds assigned the vessels of the *Helgoland* class are authoritatively quoted as:

	Knots.
Oldenburg	21.5
Ostfriesland	21.239
Thüringen	21.075
Helgoland	20.81

The *Kaiser* is the first turbine driven large vessel built and engined by the Imperial dockyard at Kiel. The Imperial dockyard at Wilhelmshaven follows when they finish the new cruiser of the line "S." The next turbine battleship to have her trials will be the *Friedrich der Grosse*, which has A. E. G. turbines. The *Kaiser* has Parson's turbines.—*Revue Internationale.*

The German review, *Schiffbau*, publishes the high speed made by the *Kaiser* and attaches thereto an interesting comparison of the speeds made by the fastest battleships of the five most important maritime powers:

	Knots.
Germany: *Kaiser*	23.6
England: *Neptune*	21.8
United States: *Utah*	21.6
France: *Voltaire*	20.7
Japan: *Kawachi*	20.5

This table shows that the *Kaiser* is ahead of her nearest competitor by 1.8 knots. We hope that her sister ships will even succeed in beating their contract speeds in like manner so that the squadron will be homogeneous. The speed of a squadron is always that of its slowest unit, therefore if one of the other vessels, *Kaiserin, Friedrich der Grosse*, and *Prince Regent* should only reach a speed considerably less, which is quite possible, due to the fact that all are fitted with different types of turbines, the excellent result reached by the Imperial dockyard at Kiel will lose its importance for the German Navy.—*Revue Internationale.*

The *Florida's* speed is given as 22.54 knots, while the English *Vanguard* is credited with 22.5 knots, which facts modify the above table considerably.

TORPEDO-NET STOWAGE ON THE "MOLTKE."

The above kodak taken of the *Moltke* in New York harbor in June last is reproduced here as showing the stowage adopted for the nets. The booms, lead of gear, etc., are quite well indicated. A description of this Bullivant net may be found in PROCEEDINGS No. 142, on page 786. The best time of "out nets" made is three minutes.

The lowness of her gun positions is also well shown, and this has been the cause of much unfavorable comment. These after guns are swept by seas in any moderate weather.

THE "STRASSBURG."—The new cruiser *Strassburg* has arrived at Kiel after doing her trials near Danzig. It is reported that these were run partly in very heavy weather, and that the vessel rolled to an alarming degree. In fact, the trials had to be interrupted, and the cruiser has gone to Kiel to have bilge-keels fitted. The *Magdeburg* and *Breslau*, of the same class, are believed to have had fine weather during their trials, so that their behavior in rough weather has still to be ascertained, but as the four ships of this class are identical it is probable that all are indifferent sea-boats. The transfer of major naval operations from the Baltic to the North Sea

is likely to have an important effect on the design of small cruisers. There is no reason to believe that any of these vessels of recent date fall short of the high German standard of robust construction and seaworthiness but it is a fact that the original design, which has been adhered to essentially in spite of increasing displacement, took more count of Baltic than of North Sea conditions. Lines almost destroyer-like were combined with structural lightness and great engine-power, the result being miraculous speed in smooth water. But experience has proved that anything like continued service in average North Sea weather wears down these vessels amazingly. The "maximum speed" figure, which was easily exceeded on trial by several knots, drops steadily every month, until an alarm is raised and the vessel goes into dockyard hands.

In the foregoing comment there is no intention of disparaging German material, but the question has a special interest for naval students in England in view of the fact that cruisers lately built and now building for the British Navy seem to claim the German *Kleine Kreuzer* as their prototype.

Marine Rundschau.

GERMAN CRUISER "BRESLAU."

although there is apparently less ambition to reach record speeds. Modern strategy appears to demand the construction of certain units, apart from torpedo craft, of phenomenal velocity, and due attention is being paid to the demand. But it seems an extravagant and unsatisfactory policy to build ships which lose their raison d'être a very few years after entering the service.—*Naval and Military Record*

THE "BRESLAU" CLASS OF CRUISERS.—This class of scout cruisers has shown great speed and is an advance over previous ones mainly in coal-carrying capacity which is 450 to 1200 tons. Turbine drive is used in all, though these are of different makes, those of the *Breslau* being A. E. G., those of the *Magdeburg* being Bergmann. Length is 446 feet, beam 45 feet, mean draft 16.7 feet, with displacement about 4700 tons. Armament is twelve 4.2-inch rapid-fire guns with two submerged tubes. The horse-power is 2400 I. H. P. There are 16 water-tube boilers.

On trials the *Breslau* made 30.4 knots, and the *Magdeburg* 27.5 knots, the rated speed of the class being 26.75 knots.

These cruisers have a different appearance from most German vessels, particularly in the lines of the bow, there being no ram, and the shape of the funnels. The height of the two forward guns indicates they can be used against destroyers in any sea.

GERMAN DESTROYERS.—The newest German destroyers are to carry only two 24-pounder guns instead of the 4.1-inch weapons with which they are credited in certain reference works. It is, of course, well known that the destroyer, as such, does not figure in the German Navy, these vessels being designated by the name of "large torpedo-boats." In that term we get the key to the development of these craft in Germany, whose torpedo-craft have always been notable for their comparatively weak gun armament. It will be seen that on an average English destroyers are more than twice as strong in gunfire as their German contemporaries. Indeed, the newest German vessels will have a gunfire greater by only six pounds than that of the English old 27-knotters. On the other hand, recent German vessels have been considerably faster—a fact which may reasonably be held to make the superior gunfire of English destroyers of somewhat problematical value. The essentially torpedo-boat character of the German vessels is seen by their high speed and greater torpedo armament when compared with our craft. This can be shown most strikingly by a comparison between the fully commissioned vessels of the two navies, there being 68 English and 66 of Germany's. English 68 destroyers all carry two tubes, giving a total of 136. Of the German 66, twenty-two have four tubes and forty-four have three, giving a total for the whole of 220.—*Naval and Military Record.*

SHIPBUILDING.—The delays in the completion of the German ships of the 1912 program caused by the five months strike in the shipyards of Schichau at Dantzig have been the subject of much confidential inquiry between the Minister of Marine and the directors of that establishment.—*Moniteur de la Flotte.*

TARGET PRACTICE.—According to the Berlin correspondent of *The Navy*, the organ of the Navy League, the German Navy intends in future to adopt long-range firing on American lines. At present the Germans do their battle practice at seven thousand yards only, while other nations fire at eleven thousand or so.

It now occurs to the Germans that their theory of sailing within six thousand or seven thousand yards and then bringing into action every gun with a certainty of hitting may be rudely upset by an enemy that starts getting in bad hits at eleven thousand yards.—*The Engineer.*

It is reported on good authority that the battle practice of the first squadron next year will be conducted on principles entirely new to the German Navy. At least one target-ship, and probably two, will be prepared for this occasion. The ships taking part will fire only half their quota of ammunition at individual practice, reserving the remaining half for squadron firing at the target-ships. This squadron practice will be of the order known in the French Navy as salvos alternées et cadencées, which seems to be becoming general among the leading navies of the world, and was tried with conspicuous success by the German cruiser-squadron in the Far East. Extraordinary interest will attach to this practice, in view of the fact that all the first squadron's ships are *Dreadnoughts.* Including the flagship *Friedrich der Grosse,* the squadron has an aggregate broadside of thirty-two 11-inch and forty-two 12-inch guns. To reap the full benefit of the method of fire delivery to be tried next year it is essential that there should be perfect communication between the participating ships, and this in turn involves the difficult problem of the

rapid and accurate transmission of signals in action. It is too much to hope that some account of the firing will be made public, such as was given out after the *Hero* and *San Marcos* bombardments, although a great many people would be glad to learn, inter alia, how long the ill-fated hulks serving as the targets were able to withstand the concentrated fire of 74 big guns!—*The Naval and Military Record.*

THE GERMAN MANEUVERS.—The high sea fleet of which the first squadron counts eight *Dreadnoughts* with three battle-cruisers, was reinforced by the 3d squadron composed of the *Wittelsbach, Schwaben, Mecklenburg, Zaehringen, Wettin* and *Elsass* manned by reserves for the most part. This squadron was given a "shake down" cruise before joining the fleet. With it were 66 destroyers, 12 submarines, 22 mine layers, and 6 auxiliaries. In the fleet were counted 39 battleships and 11 protected cruisers.

This armada is described in the press as the exact fleet with which Germany would take to sea if war should begin at this hour. The maneuvers, to be carried on in the presence of the Kaiser, who will be on board the flagship *Deutschland*, will be based on the theory that a superior force—meaning, of course, the British fleet—has blockaded the North Sea, and, having blocked up the German fleet within the blockade area, is seeking to find it and compel it to fight a decisive engagement.

It becomes increasingly plain from day to day that all the energies of the German Navy Department, like those of the British Admiralty, are directed exclusively toward the possibility of an Anglo-German Armageddon in the North Sea. It was announced, for instance, by the German Navy Department this week that the island of Borkum, which has hitherto possessed only second-rate coast defences, is about to be converted into a first-class fortified position like Helgoland, which has been called the German Gibraltar.

Borkum is one of the islands covering the entrance to the Channel which leads to Emden, and its new fortifications are with a view to preventing a blockade of the mouth of the Ems.

The plan of this year's exercises reflects the probable conditions of a North Sea campaign, in which the German fleet, outnumbered in ships, would have to make full use of its island and mainland bases to frustrate a blockading force and gain the open sea to fight or fly as circumstances dictated. Helgoland is expected to serve as the center of the maneuver zone. The garrison of this island was heavily reinforced.

It is perhaps not without significance that these naval maneuvers were accompanied by the principal officers of the army. The chief of the general staff of the German Army, together with Field-Marshal von der Goltz, General von Heeringen, the Prussian Minister for War, the inspector of field artillery, the chief of the engineer and pioneer corps, and the commanders of three army corps watched from the principal ships the special maneuvers.—*Naval and Military Record.*

The maneuvers took place entirely between Wilhelmshaven, Cuxhaven and Helgoland in the North Sea. They were divided into two parts, the first from 2d to 15th of September consisting of battle practice and maneuvers, the second from 16th to 19th in which the Kaiser assisted. These began by grand review held on the 15th, the Kaiser being on board the *Deutschland.*

As a spectacle, the grand naval review off Helgoland on the 15th inst. was marred by the vile weather, but as an exhibition of German power in the North Sea its impressiveness was perhaps enhanced by the lowering skies and troubled waters. Forty-one battleships and cruisers steamed past the flagship *Deutschland.* Something like seventy smaller craft could be counted. At the appropriate moment when the guns of the fleet begun to crash out the "Kaiser salute," the Zeppelin airship *Hansa* made its appearance, hovering above the flagship and executing maneuvers in the teeth of

an exceedingly strong wind, and altogether demonstrating her wonderful handiness to the most hardened sceptics. It is only fair to state that the cruise of the *Hansa* from Hamburg to Helgoland, a distance of nearly 120 miles, was made against a head wind which averaged a velocity of 50 feet per second, notwithstanding which she flew with marked steadiness, and appeared to be under complete control.

One remarkable feature of the review was the (to foreign eyes) unnecessary hardship imposed upon the seamen of the destroyers. As these boats steamed at high speed past the Imperial flagship their crews lined the decks, in spite of the heavy seas and sheets of spray which almost hid them from sight. The men must have been drenched through and through, and their position was palpably dangerous, but it was impossible not to admire the rigid discipline which kept them in this unenviable situation for several minutes whilst they were in view of the Supreme War Lord, who stood on the bridge of the *Deutschland*. On the whole, the weather conditions were typical of the North Sea. Henceforth, as the maneuvers and the concluding parade have testified, the fleet of the Fatherland is to work out its destiny in the grey and turbulent water of the North Sea.—*Naval and Military Record.*

Touching the maneuvers themselves, the strategical and tactical operations performed, the incidents which attended them, and the issue of the mimic campaign, there is, as was to be expected, complete silence. In one important detail, however, they appear to have resembled the late British maneuvers, viz., in the almost complete absence of breakdown and minor mechanical defects. This, of course, apart from the unfortunate destroyer mishaps which occurred. The immunity of the high sea fleet from engine-room defects is due less to good luck than to the efficiency of the corps of naval engineers, and their subordinates, combined with a steadfast attention to duty which seems to have become a characteristic of this branch in all the great navies of the world.

No newspaper men were admitted so nothing is known as to the actual workings of the fleet. The endurance of the large torpedo-boats was exceptional, they keeping the sea in vile weather.

At the conclusion of the naval maneuvers the Emperor made the following wireless signal to the fleet:

"I express to the high seas fleet and the divisions attached to it for the autumn maneuvers of the coast defence forces my fullest acknowledgment for what they accomplished before me, and my warmest thanks for their diligent and faithful labor to increase our readiness for war."

The Lokalanzeiger announces that Admiral von Hollzendorff has consented to serve another year at the express wish of the Emperor.

ACCIDENT.—The German torpedo-boat *G 171* ran under the bows of the battleship *Zähringen* the afternoon of September 14 in the course of maneuvers southwest of Helgoland and was cut in two. Six men were drowned, and a seventh died soon after beng picked up from the water. The torpedo-boat sank at a spot where the water is 16½ fathoms deep, and will, it is expected, be raised. The *G 171* was launched in 1909, and belongs to the second torpedo-boat flotilla. She has reached a speed of 34.6 knots.

THE GERMAN FLEET LAW.—The new fleet law promulgated by Germany is of much interest. The argument states that the organization of the fleet suffers from two serious defects:

(1) In the autumn of each year all the time expired men—about one-third of the crew in all the ships of the battle fleet—are discharged and replaced by recruits that are mainly from the inland population. Owing to this the readiness of the battle fleet for war is considerably impaired for a considerable period; and

(2) That with an establishment of 58 capital ships *only* 21 ships are available at first if the reserve fleet cannot be made ready in time.

The law designs to relieve the first and second squadrons of the high sea fleet by giving six months training to every conscript before he is put into the absolutely first fighting line.

As regards the second defect we find that getting the reserve fleet ready for war in *proper* time becomes more and more unlikely owing to the ever-growing complexity of modern ships and of the steadily growing difficulty in training large organizations. At the present day, therefore, the reserve fleet can be considered only as a second fighting line, but in view of German strength in reserve men it still maintains its great importance.

Thus the logical way to remove both the defects is the formation of a *third active squadron* which will be done by this law.

The actual strength of the fleet will be 61 battleships and battle-cruisers with 40 protected cruisers instead of 38. The fleet for service in foreign waters is to be composed of 10 first-class cruisers and 10 protected cruisers.

The increase in personnel requires an annual increase of 75 officers of all corps and 1600 men up to 1920.

The high sea fleet will now be composed of one fleet flagship, five squadrons of eight battleships each, 12 large cruisers, and 30 small cruisers.

Torpedo-boats are to be 144 with 99 in full commission.

The increase in battle-cruisers is four, and in small cruisers is six.

It is worth while noting that Germany has a mercantile marine of 533 steamers over 3000 tons displacement, with some of the finest and swiftest vessels in the world included in the list. These carry their guns and fittings in the holds and are manned by 64,000 seamen of whom a large proportion are reservists.

INCREASE IN BUDGET.—Additional funds will be demanded of the Reichstag in order to meet the expenses of the increase of men for the submarines. Furthermore a sum of 10 millions to demanded for reinforcing the defences of Cuxhaven, the batteries of which are to be rearmed with 12 and 15-inch guns.

INFORMATION FORBIDDEN.—Very little of the German fleet ever appears in print, the facts concerning it are always hard to obtain, and this condition is evidently to continue to an increased extent in the future. Judging from the following from *La Moniteur de la Flotte:*

"The Germans complain of the indiscretions of the journals and the press bureau has addressed to their publishers a circular letter demanding that they suppress news relative to new material, to inventions and to the equipment of the army and the fleet. The letter says that the publication of such news facilitates the task of foreign spies, and points out what news ought to be avoided in the future. 'For some time the characteristics of the German submarines which regularly ought to be confidential have been given. Only a short time ago a complete description of the new Erhardt gun was published, although it had just been bought by the authorities. In the public interest Prince Henry then took the gun, mounted it on board ship, and tested it, because in such a place no unauthorized people could see it. Such indiscretions, which all serve the enemy, ought to be avoided.' The letter closes by saying that the German press ought to be able to do as the foreign press does 'which publishes only rarely details on military subjects concerning their own country.'"

GREAT BRITAIN

VESSELS BUILDING

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Ajax.....	23,500	21	10 13-5-in., 16 4-in.	Scott (Greenock)	Launched March 21, 1912
Audacious.....	24,000	21	same	Cammel Laird (Birkenhead)	" Sept. 14, 1912
Centurion.....	24,000	21	same	Devonport	Completing trials
King George V	24,000	21	same	Portsmouth	Commissioned Nov. 16
Benbow	26,000	22	10 13-5-in., 16 6-in.	Beardmore	Laid down May 30, 1912
Delhi.....	26,000	22	same	Vickers	" May 31, 1912
Iron Duke.....	26,000	22	same	Portsmouth	Launched Oct. 12, 1912
Marlborough..	26,000	22	same	Devonport	" Oct. 24, 1912
Qu'n Eliz'b'h*.	30,000	29	10 14-in.	Portsmouth.	Keel laid Oct. 21, 1912
Warspite*.....	30,000	29	same	Devonport.	" " " 31, 1912
Battle Cruisers		28			
Princess Royal	27,500	28	8 13-5-in., 16 4-in.	Vickers	Commissioned Nov. 15, '12
Queen Mary...	28,850	30	same	Palmer	Launched March 20, 1912
Tiger.....	28,850	25	same	Brown & Co.	Building
Australia.....	18,750	25	8 12-in., 16 4-in.	"	Launched Oct. 25, 1911
New Zealand..	18,750		same	Fairfield	Completing trials
Protected Cruisers					
Chatham	5,500	25.5	8 6-in., 4 3-pdrs.	Chatham	Undergoing trials
Southampton..	5,500	25.5	same	Brown & Co.	Completed trials
Dublin	5,500	25.5	same	Beardmore	Commissioned Dec. 1
Nottingham...	5,400	25	10 6-in., 4 3-pdrs.	Pembroke	Laid down June, 1912
Birmingham ..	5,400	25	same	....	....
Lowestoft.....	5,400	25	same	....	" " July 28, 1912

*The other two battleships of the 1913 program have been designated the *Valiant* and *Barham*, and are to be built by Fairfield, of Glasgow, and Brown, of Clydebank, respectively. No details of these vessels are known as yet.

SHIPBUILDING.—The winter months will witness exceptional activity in naval shipbuilding, both in government and private yards. Under the Supplementary Estimates for the navy this year money was obtained for expediting new construction. All the destroyers, 20 in number, were ordered in the early spring, contracts for eight light-armored cruisers have recently been placed, and the laying down of the four large armored ships is to be expedited. For the first time on record a battleship has been laid down at Portsmouth within nine days of the launch of a battleship from the same slip. The first keel place of the new vessel was laid by Lady Meux on October 21, and it is stated that an effort will be made to launch her within four or five months. Usually a considerable interval takes place between the launch of one ship and the commencement of another on the same building slip, but in the present instance only one working week elapsed between the floating of the *Iron Duke* and the laying down on the same slip of the first armored ship in the 1912-13 program.—*Naval and Military Record.*

This vessel is probably to be an oil burner. She will have a partial installation of motor engines. The name *Trafalgar* is not unlikely, due to the date on which keel was laid. Length is to be 601 feet. This is the 33d battleship of the *Dreadnought* type.

The new British battleships just laid down under the 1912-13 naval program will not be launched until June next. It is understood that these ships will not be much larger than the *Iron Duke* and *Marlborough*. In addition to the ten 14-inch guns (compared with the 13.5-inch of the earlier vessels), a much higher speed, and better armor protection, the two new ships will carry a number of anti-air-craft guns, probably 4-inch. The mountings will

enable these guns to be elevated to 80 degrees, and a 31-pound shell will be used, with a charge sufficient to send a projectile to a height of 27,000 feet. The shell will be shrapnel, with a time fuse, and a bursting charge to scatter the fragments and bullets over a wide area.—*Shipping*, Illustrated.

H. M. S. "AUDACIOUS."—H. M. S. *Audacious* was launched on September 14 from the Tranmere yard of Messrs. Cammel, Laird & Co., Ltd. The launching ceremony was performed by Countess Lytton, who was accompanied by Lord Lytton. This vessel is the last of four battleships laid down under the 1910-11 program, the others being the *George V* (Portsmouth), *Centurion* (Devonport), and *Ajax* (Scott's). The vessels are 555 feet B. P. and 89 feet beam, with a load draft of 27 feet 6 inches, displacing over 23,000 tons. Parsons' turbines give a speed of at least 21 knots, with a S. H. P. of 31,000. The armament consists of ten 13.5-inch guns in five twin turrets of center line of ship, also sixteen 4-inch guns.—*Marine Engineer and Naval Architect.*

The *Audacious* is the 27th British ship of the *Dreadnought* type to go afloat, and, while the period spent on the stocks by the previous 26 vessels averaged only 10 months and a quarter, the *Audacious* will have been no less than 18 months on the slipway. The delay is accounted for by the builders having had various labor troubles to contend with, several sections of their workmen having come out on strike one after another and so dislocated the whole of the work in hand. The original contract date for completing the ship was January 16, 1913, but it is now probable that she will not be ready until nearly the end of that year.—*The United Service Gazette.*

NOTES ON THE "KING GEORGE V."—The officers are berthed aft. Her mast is stayed with wire rigging, the tripod type being discontinued. This vessel was commissioned November 16, or in less than two years after the laying down of her first keel plates. She has completed satisfactorily her 24 hours graduated steam trials. The ship was driven at a speed of over 18 knots hour after hour, against a heavy head sea, which at times broke over the forecastle in such quantities as to send the crest of the sea to the top of the navigating bridge. Out of this severe trial the controlling and securing fittings emerged most satisfactorily, while the behavior of the ship was such that it would have been possible to have fought every gun, if necessary.

The fire-control equipment of the *King George V*, provides for each barbette being individually fought, even though the mast may be wrecked by shell fire or the adjacent barbettes disabled, while during an action all changes of range, etc., would be conveyed direct to the sighting positions, thus enabling a continuous fire to be maintained. As all the guns are fired through electric generators, the risks of misfires will be reduced to a minimum.

The Whitehead torpedoes, of 21-inch diameter, are provided with range-firing directing instruments, a new and important innovation, which will ensure accurate runs being obtained, and as these instruments and the weapons themselves are provided with fittings which allow for changes of course of both ship and enemy, they may be classed amongst the most formidable yet installed. The preliminary trials of the magazine cooling appliances showed them to be thoroughly reliable under service conditions, the temperature of each of the magazines being satisfactory. The electric motors actuating the plant are of the newest design, and possess a good reserve of power.

THE "IRON DUKE" CLASS.—The four battleships of the *Iron Duke* class will each mount ten 13.5-inch guns of the latest Mark, and sixteen 6-inch quick-firing guns as secondary armament. This is a further advance in gun power, for whereas the main armament will correspond with that of the *King George V* class, the restoration of the 6-inch gun will give the *Iron Dukes* a superiority over all previous battleships of the *Dreadnought* era, which carry complements of either sixteen or twenty 4-inch guns as

Cribb, South Sea.

ENGLISH BATTLE-CRUISER "LION."

The *Princess Royal* is identical in appearance to the *Lion*.

Cribb, South Sea.

"KING GEORGE V."

Cribb.

BATTLE-CRUISER "NEW ZEALAND."

their secondary armament. The collective fire delivery of each of the *Iron Dukes* will be as follows:

Gun	No.	Weight of projectile	Total weight
13.5-inch	10	1,400 lb.	14,000 lb.
6-inch	16	100 lb.	1,600 lb.

The 6-inch guns will be placed in batteries well above the water-line and behind armor.

The external armor of the *Iron Dukes* will be carried well below the water-line to the crown of the gun-deck, and reinforced by internal armor over the vital parts, while to protect the hull below the water-line against submarine or torpedo attack an arrangement of sub-divisional bulkheads has been introduced.—*Naval and Military Record.*

This class of battleships is not to be "soft-ended," as at first designed. The armor belt is to be carried further forward and further aft until the soft-ends will be hardly appreciable. The other improvements in this class include an arrangement for the conning-towers to be used as control positions if the platforms up the mast are destroyed by gun-fire. The foremost tower of the two will be of an enlarged type, and the after tower will carry a control station for directing the gun-fire of the after turrets. All the turrets will, in accordance with recent practice, be on the middle line; the guns of the second foremost and the second after turret swinging their muzzles over the turrets in front of them, in training from one side of the ship to the other. The 4-inch guns for resisting torpedo attack are being placed in armored case-mates wherever possible, so as to give the gun's crew ample protection. The ship will not carry tripod masts, as her older sisters have done, and the funnels will not correspond to previous types. These will, altogether, be very formidable ships, showing another step in warship evolution.—*United Service Gazette.*

BATTLE-CRUISER "PRINCESS ROYAL."—This vessel is a sister ship of the *Lion,* a photograph of which ship is produced herewith.

The new British battle-cruiser *Princess Royal,* was constructed and engined by Messrs. Vickers, Ltd., Barrow-in-Furness, and was launched on April 29, 1911. She is 660 feet long, 88 feet 6 inches beam, and on a draft of 28 feet has a displacement of 26,350 tons. The armament embraces eight 13.5-inch breech-loading guns mounted in pairs in barbettes on center line. The 4-inch guns are disposed behind armor. The turbines are of the Parsons' type, driving four shafts and four screws. There are two high-pressure and two low-pressure ahead turbines, and a corresponding arrangement of astern turbines.

In arranging the program of official trials for the battle-cruiser *Princess Royal,* just completed by Messrs. Vickers (Limited), Barrows-in-Furness, the Admiralty have departed from the practice followed for many years by deciding that the vessel's gunnery, and torpedo trials should precede the tests of her propelling machinery. So far as can be seen at present, there is no reason to regret the change, for the gunnery and torpedo tests, which were commenced on September 7 and concluded on September 8, are reported to have been completely successful.

To torpedo trials on September 7, exceptional interest attached, owing to the fact that for part of the time that the vessel was steaming up and down the Channel, after leaving Cawsand Bay in the morning, the Admiralty required torpedoes to be discharged while the battle-cruiser was at full speed. Special care is being exercised to prevent details as to the vessel's steaming becoming public, but inquiries leave no doubt whatever that while travelling at full speed, as well as during the remainder of the day, she behaved splendidly. Except when she was turning, there was almost an entire absence of vibration, and it is stated that she attained a speed of between 30 and 31 knots.

She returned to Plymouth on the evening of the 12th on completion of her eight hours full-power trial in the Channel. This trial is the most exacting of the whole program of official tests, but the vessel, as was anticipated, came through the ordeal with results which must be exceedingly gratifying to the contractors (Messrs. Vickers, Limited). The full-power trial necessitated the maximum power for which the vessel was designed, namely, 70,000 horse-power being maintained for the full eight hours. It is understood that this was done with ease, the engines not being put to their full test, and, consequently, it is impossible to state the highest speed which the vessel may be capable of attaining. In fact, it is stated that steam was being let off continually throughout the trial. Therefore, it might be assumed that when her speed tests take place, she will lower the colors of her only sister ship, the Devonport-built *Lion*. The engines of the two vessels are by the same firm.

It was after taking in upwards of a thousand tons of coal that the *Princess Royal* left the Sound about six o'clock on that morning. The required speed was quickly reached, and the trial included some half-dozen runs over the measured mile course off Polperro. Several subsidiary trials were to have been carried out at the conclusion of the eight hours test, but these had to be curtailed and only the circle trials were completed. Her speed was 31.7 knots for the eight-hour trials. Horse-power between 80,000 and 90,000. The *Princess Royal* went into the Channel again on next day for starting, stopping, reversing, steering, and astern trials. On completion of these she returned to Plymouth and subsequently went up harbor preparatory to being placed in No. 8 dock at the North dockyard.

While in this dock—and it is interesting to note that this is the dock that was lengthened to accommodate the *Lion*—her propellers were changed. She remained in dock until September 18. Upon all her trials the behavior of the new battle-cruiser as a sea-boat, has been all that could possibly be desired, but it must be admitted that all the tests have been carried out under most favorable weather conditions. In the full-power trial on September 12, it was especially noticeable that the engines worked most smoothly, the only vibration being a steady, gentle throbbing, this being chiefly felt in the after part of the ship over the propellers. While trials of this kind are in progress the stokers usually get a hot and tiring time in the stokeholds feeding the huge furnaces, but their task on September 12 is stated to have been comparatively comfortable.

The vessel again left Plymouth Sound on September 13 for subsidiary tests, which included starting, stopping, reversing steering, circle, and astern trials with satisfactory results. The vessel returned to Plymouth in the afternoon and anchored in Cawsand Bay. She went into harbor on September 14.

The improvements embodied in the *Princess Royal*, as the result of the experience gained in the *Lion*, have fully justified the delay in completing the new ship. The interference with the control fittings which was a feature of the *Lion's* trials—with the foremost funnel in front of the mast—has now disappeared as the result of the removal of the funnel abaft the mast, while the lengthening of the three funnels by ten feet and their enlargement has reduced the flaming and over-heating to a minimum.

New propellers were fitted to the vessel in deck, and in further trials in the Channel on September 21 she attained the speed of 34.7 knots. Under natural draft average speed was 29 knots, and an average of six runs under full power gave 33 knots speed.

The weather was unusually good for these trials, and this fact contributed to her exceeding the *Lion's* speed.

The figure 34.7 may be excessive, but it has been creditably reported, though the *Naval and Military Record* says the following:

"The London correspondent of the *Yorkshire Post* says: The greatest secrecy is being maintained by the Admiralty regarding the result of the full-power trial of the *Princess Royal*, but I am credibly informed that, as

I anticipated, the maximum speed exceeded 32 knots—to be exact, 32.4, nearly a full knot in excess of the record made by her sister ship the *Lion*. The engines are declared to have developed between 80,000 and 90,000 horse-power at one period of the eight hours trial, compared with their designed horse-power of 70,000. It must be taken into account, however, that the trial was carried out under unusually good weather conditions. There were no such stormy seas as those through which the *Lion* had to plough when undergoing similar tests."

A new set of four-screw propellers has been fitted, and she will carry out a series of trials exactly corresponding to those now so satisfactorily terminated. The idea (says *The Times*), is to ascertain the effect on speed of propellers of different proportions in order that the same high efficiency may be realized from propellers as from the other parts of the mechanism. It is well known that knowledge is less definite as to propellers than as to other factors in ship propulsion, and the Admiralty decided that a thoroughly practical test should be made with both the *Lion* and the *Princess Royal*, sister ships. In the case of the *Lion*, new propellers were tried after the vessel went into commission; in the *Princess Royal* the trials are to be made at once. Thus the Admiralty will have data for four sets of propellers, with the minima of variation in other factors, since both ships and propelling machinery are alike. The *Lion*, although built at Devonport, was supplied with her machinery from Vickers' works, where the jig and gauge system adopted ensures absolute precision, and thus the machinery is exactly the same, which makes possible accurate deduction between the performances of the ships. It would be imprudent to state with any detail the results so far of this experiment, but, satisfactory as was the performances of the *Lion*, these have been exceeded by the *Princess Royal* to the extent of one nautical mile per hour at full power.

"NEW ZEALAND."—The trials of this vessel began on October 9. A complete program of her trials is of interest and is given:

The trials September 28. The ship is to leave Greenock on September 29, arriving at Devonport on the 30th. From October 1 to October 9 she will be in dock. She will then begin her 30-hours trial, and anchor in Plymouth Sound on October 10. She arrives at Spithead on October 14, and will carry out steering and circle trials on the 15th; from the 16th to 19th air compressor trials, torpedo and gun drills; on the 21st gun trials; and on the 22d torpedo and anchor trials. The vessel will leave for Fairfield on October 23, carrying out magazine and cooling trials on the way north.

This battle-cruiser was built at the order of the New Zealand Government at the Fairfield Shipbuilding Co., Govan, and has been donated by New Zealand to the English Admiralty. The reports to date of her trials give her attained speed as 27 knots.

This vessel, built by the Dominion of New Zealand originally for her navy, has been presented by the people of the Dominion to the Admiralty in order to show their patriotism and their belief that all parts of the empire have a common interest in maintaining English naval supremacy. She may be employed when and where the Admiralty pleases.

NEW PROTECTED CRUISER.—The second-class protected cruiser *Sydney*, just launched, is one of four provided for under the 1910-11 program, and is being built to the order of the Australian Commonwealth by the London & Glasgow Engineering & Iron Shipbuilding Co., Ltd., Govan. These vessels are light unarmored ships intended for reconnaisance work in association with the more powerful armored cruisers of a fleet. Being possessed of a speed of 26 knots, they should prove most serviceable. They are not intended to penetrate the screen of the enemy's force, and the armament is therefore limited to 6-inch bow and stern chasers, three 6-inch guns on each side, four 3-pounders, and a few smaller guns. They also carry two

submerged tubes for 21-inch torpedoes. They may be regarded as developments of the *Town* class, and whereas the horse-power developed in the *Town* class was 22,000, the *Sydney* will develop 25,000. In addition to this power advantage the *Sydney*, though being the same length between perpendiculars as the *Town* class (viz., 430 feet), has a breadth extreme of 49 feet 10 inches, against 48 feet 6 inches, a mean of draft of 15 feet 9 inches, against 15 feet 6 inches, and a displacement in tons at load draft of 5400, against 4800. The safety of the vessel in the event of damage being sustained has been well provided for, the vessels being subdivided into numerous water-tight compartments. Additional protection is afforded by water-tight coal bunkers, which extend along each side of the vessel. The magazine and shell rooms are lighted and ventilated on the latest system, and kept at a low, even temperature by special refrigerating plant provided for the purpose.

The Sydney's Machinery.—In general appearance the Sydney will resemble the *Yarmouth*, launched by the builders last year, the main difference being, continues the *Morning Post*, that in the new vessel the forecastle extends for about two-thirds the vessel's length, which forms a boat deck and provides additional accommodation for officers, crew, storerooms, etc. She has two masts, both fitted with yards, for wireless telegraphy and signalling, the foremast also carrying a fire control platform The funnels are four in number. A belt of protective plating is carried right fore and aft, extending from the upper deck to well below the waterline. The vessel will be electrically lighted throughout and fitted with four searchlights, electrically driven coaling winches, ammunition hoists, fresh and salt water pumps, and ventilating fans. A complete system of voice pipes, telegraphs and telephones, and a submarine sound signalling apparatus will be installed. The turbine machinery driving four propeller shafts is contained in three separate engine rooms abreast, the main condensers and auxiliary machinery being in two compartments directly aft of the main engine rooms, while the 12 water-tube boilers are placed in three separate boiler rooms. The double bottom which extends under the machinery spaces and the forward and after magazines is sub-divided into numerous compartments, some of which are used for carrying oil fuel and reserve feed water for boilers. The propelling machinery is of the Parsons' turbine type of 25,000 shaft horse-power at 500 revolutions. When going ahead all shafts revolve outwards. The propellers (four in number) are of manganese bronze. The main steam and maneuvering gear for all turbines is arranged on the forward bulkhead in the center engine room. There being no cruising turbines a special series of blades for cruising purposes are fitted in each high-pressure turbine. The boiler rooms are adapted for use with the closed stokehold system of forced draft, the supply of air being provided by steam-driven fans. Oil pumps are provided for both oil fuel and forced lubrication purposes.—*Page's Weekly.*

LIGHT ARMORED CRUISERS.—Orders have just been provisionally placed by the Admiralty for four light armored cruisers, two with Messrs. Vickers (Limited), Barrow-in-Furness, and two with Messrs. W. Beardmore & Co. (Limited), Dalmuir. Two others of the eight in this year's program are to be built at Chatham and Pembroke respectively.

Mr. Churchill said on March 18 last that these cruisers "will be the smallest, cheapest, and fastest vessels, protected by vertical armor, ever projected for the British Navy. They are designed for attendance on the battle fleet, to be its eyes and ears by day and night, to watch over it in movement and at rest. They will be strong enough and fast enough to overhaul and cut down any torpedo-boat destroyer afloat."

It is understood that five of the new light-armored cruisers are to have Parsons' turbines and three Brown-Curtis turbines. The Parsons' ships will be Messrs. Beardmore's three and Messrs. Vickers' two. Fairfield's ship is to have Brown-Curtis turbines, and so are the two ships which are

to be built at Chatham and Pembroke respectively. The contractors for the machinery of the dockyard ships are the Thames Ironworks Company.

Orders have been given that the sick bay fittings of all new ships are to be inspected by an officer from the department of the Medical Director-General immediately after the completion of the steam trials. The sick bay and medical distributing stations are to be completely fitted up prior to a new ship proceeding on her steam trials. At the conclusion of the steam trials, and before the medical officer borne for the trials leaves the ship, arrangements are to be made for the inspection of the sick bay and medical distributing stations by an officer from the department of the Medical Director-General, so that the experience of the medical officer during the steam trials may be obtained by the inspecting officer and to ensure that the arrangements fitted are satisfactory.—*Naval and Military Record.*

Cribb.

ENGLISH SCOUT CRUISER "ACTIVE."

THE "ACTIVE."—This is one of a class of three scouts to be completed in 1912, the others being the *Amphion* and *Fearless*. Their displacement is 3360 tons, length 385 feet, beam 41½ feet, draft 14 feet. Armament is ten 4-inch guns, with two above-water torpedo tubes. Speed is 25 knots. Boilers are Yarrow. Engines are Parsons' turbines.

H. M. S. *Lurcher*, one of the torpedo-boat destroyers of the *Firedrake* type, attained during a continuous run of eight hours the mean speed of 35.34 knots, thus exceeding the contract speed of 32 knots by 3.34 knots. The vessel is 255 feet long by 25 feet 7 inches beam, and is propelled by Parsons' turbines, driving two shafts, the steam being supplied by three Yarrow water-tube boilers fitted with that firm's latest feed-heating device.

The *Lurcher* is thus one of the fastest destroyers that has ever been built, and is an important addition to the British Navy.

The British torpedo-boat destroyer *Hardy*, has been launched from the Thoryncroft yard, near Southampton. She is the first destroyer belonging to the British Navy to be driven by Diesel oil engines. The vessel, which has been designed to do 32 knots, will use turbines for her full speed, but

the value of the oil engines will be found at moderate cruising speeds, in which it is considered to be certain that they will make for both economy and efficiency. The *Hardy* was laid down less than a year ago, and it is likely that she will be delivered to the Admiralty in about two months.—*Shipping*, Illustrated.

NEW DEPOT SHIP FOR SUBMARINES.—The *Maidstone*, the first specially designed depot ship for submarine vessels, was commissioned on October 4. The *Maidstone* has been fitted out on the experience gained in the several converted depot ships which have preceded her.

The principal dimensions and equipment of the ship are as follows: Length, 320 feet; beam, 45 feet; displacement, 4000 tons; speed, 15 knots; coal capacity, 600 tons; oil capacity as fuel, 550 tons; for lubricating purposes, 50 tons. There are special appliances for handling the oil, the quantity being based on the requirements of a flotilla of twelve of the *D* class submarines.

Cribb.

SUBMARINE SALVAGE VESSEL.

The equipment of the *Maidstone* consists of large storerooms for the spare parts of machinery, torpedoes, and their explosive war-heads, primers, etc.; a dynamo room, with four sets of the new type turbo-generating machinery, the first of its kind to be supplied to the British fleet, and powerful air-compressing plant for use in charging torpedoes, etc. The workshop and machinery plant comprises (a) engineering workshop provided with the latest lathes, cutting, planing tools, etc., with an annex for dealing with torpedo defects; (b) a smithery for forging, welding, and other work; and (c) a foundry capable of handling brass, steel, and other metal castings.

The *Maidstone's* berthing arrangements, which provide excellent accommodation for 40 officers and 450 petty officers and men, are calculated to secure the comfort of the crews when off duty in the submarines. The sick quarters, canteen, culinary, bakery, and general internal equipment are admirably fitted. Electric searchlights also form part of the outfit, and the vessel is efficiently lighted with electric lamps, special fittings being provided for the workshops, medical examinations, and for oiling and coaling purposes, etc., by night.—*Naval and Military Record.*

THE SALVAGE OF SUBMARINES.—The new salvage craft which has recently been completed for the navy appears to be an effective vessel for the work she is intended to perform, viz., the lifting of sunken submarines. A salvage vessel is required which can speedily be got into position for lifting, in all moderate weather, and which, when the lift has been made, can be towed to the nearest dock with the submarine still in the slings, and there deposit its burden for repairs. It is believed that this latter function will be readily performed by the new vessel (several sisters of which are being ordered), as she is 160 feet long and 44 feet broad, and has a lifting capacity of 1200 tons, whereas our heaviest projected submarine does not exceed 1000 tons displacement. The vessel, which cost $204,120, is fitted with two powerful electric capstans on the forecastle and stern respectively, and is so shaped underneath that a submarine can, by means of large chain slings, be hoisted close up under the bottom of the salvage craft, and in this position be towed to a dock or dockyard. All this sounds well, and if the vessel realizes expectations, as it is confidently expected she will do, then, at last, a great modern naval want will have been filled, which stands to save the navy tens of thousands of pounds. The sooner a submarine is raised and placed in dock the less harm will be done to her machinery and the cheaper will be her repair for further active service.—*United Service Gazette.*

SPEEDY COALING.—While coaling at Portland in October the *Neptune* established a world's "record" by taking in 650 tons in one hour and 25 minutes, an average of 458.8 tons per hour. All the coal was taken from lighters. During her commission the *Neptune* has established a reputation for smart coaling. Before this week's performance her best average was 403 tons per hour.—*The Army and Navy Gazette.*

ENGLISH AND GERMAN SHIPBUILDING.—England puts on the stocks in 1913 5 battleships to Germany's 3; in 1914, 4 to Germany's 2; in 1915, 4 to Germany's 2; in 1916, 4 to Germany's 3; in 1917, 4 to Germany's 2. This will make 56 English battleships opposed to 35 German battleships.

THE NEW ADMIRALTY FLOATING DRY DOCKS.—On page 1130 of PROCEEDINGS No. 143 will be found a complete description of a 32,000-ton floating dock for the English Admiralty constructed by Swan, Hunter & Wigham Richardson at their works at Wallsend. This dock has been towed to and is located in the river Medway.

An illustration is here given of another dock, a sister to the above, which arrived at Portsmouth August 21, 1912. This dock was built at Birkenhead by Messrs. Cammel, Laird & Co., and the photograph shows the dock arriving in Portsmouth harbor.

The Medway dock was towed from the Tyne to the Medway by foreign tugs. The towage of the Portsmouth dock, however, was given to Liverpool tugs, although the trip was a longer and more strenuous one than in the case of the East Coast dock. The dock left the Mersey on August 14, and the weather, during the trip to Portsmouth, was a continual succession of gales. The best speed made was five miles per hour when the wind and sea were directly astern. The entrance of the dock into the harbor was a difficult undertaking, considering the intricacy of the narrow channels and the various turns that had to be made before the huge structure had been safely berthed in Fountain Lake. That a vessel 700 feet long, with walls 60 feet high above the water-line, and covering an area of two and a quarter acres, should have been brought in so successfully without touching any of the banks is considered a smart piece of management.

The berth for the new dock is alongside the end of the jetty in Fountain Lake that has been built out from the dockyard wall. This jetty, which is 124 feet in length on the face, and 143 feet from front to back, is carried on cast-iron cylinders, sunk into the clay at the bottom of the lake, and filled with concrete. It is constructed of ferro-concrete, and is provided with a superstructure of heavy steel work and railway communication from the dockyard, so that material for the repair of ships can be taken alongside the dock.

Cribb.

"BIRKENHEAD," FLOATING DRY DOCK.

The following table is of interest relative to floating dry docks. The number of greater docks built since the *Dewey* is thus considerable:

PARTICULARS OF SOME OF THE LARGEST FLOATING DOCKS IN THE WORLD.

Dock	Lifting capacity	Length	Clear width	Depth over keel blocks	Owners
	Tons	*Feet*	*Feet*	*Feet*	
Kiel	40,000	656	154	35¼	German Government
Hamburg	35,000	720	108½	33	Blohm and Voss
Medway	32,000	680	113	36	British Admiralty
Portsmouth	32,000	680	113	36	British Admiralty
Montreal	25,000	600	100	27½	Canadian Vickers Ltd.
Hamburg	25,000	525¾	108½	33	Vulcan Company
Pola	22,500	584¾	111½	37	Austro-Hungarian Govt.
Rio de Janeiro	22,000	550	100	30	Brazilian Government
Hamburg	20,000	511¼	97	26	Reiherstieg Company

DOCKING TEST.—The final lifting trial of the *Dreadnought* dock built by Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, for the British Admiralty, took place in the river Medway on Wednesday, October 2, when the battle-cruiser *Lion*, displacing 30,415 tons and drawing 31 feet

6 inches of water, was successfully docked and lifted. The actual lifting operation of the dock from a draft of 31 feet 6 inches until the pontoon deck was awash at the sides occupied three hours and ten minutes. The total distance through which the vessel was lifted was 36 feet and the total quantity of water necessary to be pumped in order to raise the deck of the dock clear of the water was about 46,000 tons. After H. M. S. *Lion* had been cleaned and painted and some necessary repairs had been effected, the dock was lowered the following morning at 8 o'clock and the ship was undocked during the day. The operation of lifting this hugh battle-cruiser was one of the greatest interest, as no ship of a similar displacement has ever been lifted out of the water by a floating dock. The time occupied in lifting the vessel was well within the limits prescribed by contract.

ADMIRALTY ORGANIZATION.—On September 7, the Admiralty issued a memorandum defining minutely how business was to be transacted in the Department. The change consists in adding the following to the organization shown on page 328 of No. 141 of the PROCEEDINGS:

An additional civil lord who does the duties of our paymaster-general relative to the supplies of the fleet.

A financial secretary who handles the accounts business of what corresponds to our Bureau of Supplies and Accounts, and

A permanent secretary to look out for general office organization.

The First Sea Lord, who corresponds to our Aid for Operations, is always to be consulted in matters of great importance by the other sea and civil lords and the secretaries.

THE NEW CHIEF CONSTRUCTOR.—The difficulty about Sir Philip Watts' successor has now been solved by the appointment of Mr. Tennyson d'Eyncourt to the chair of the chief constructor, and thus the Elswick record is carried on. Mr. d'Eyncourt was trained by and worked with Sir Philip in Newcastle, and though he left Armstrong's and worked at Fairfield for a few years, he has for some years past been working, rather side by side, than under Mr. Perrett. He is still a comparatively young man, but he has a wide knowledge of warship building and is universally respected as a designer. He has also, we believe, very definite opinions of his own, and we fully expect to see him carry on the brilliant record of the chief constructors who have preceded him at the Admiralty. The only qualification for the post in which, as far as we are at present aware, he is lacking is that he is not a member of the Royal Corps of Naval Constructors. It has been urged in some quarters that for that reason he should not have been appointed. This we cannot admit. If he was the man best fitted for the post that could be found no sentimental objection of that kind should have weight. For the time being Sir Philip Watts is assisting Mr. d'Eyncourt to pick up the threads at the Admiralty, but it is an open secret, if a secret at all, that when he severs his connection with the Admiralty he will join the board of Armstrongs. We are delighted to have to put on record also that Mr. W. H. Whiting, for many years the chief assistant constructor, has been elected to fill the post of superintendent of construction accounts and contract work, vacated by the retirement of Sir William Smith. All who know Mr. Whiting and the work that comes under the long title he now enjoys will recognize how fully he merits the appointment, and how well fitted he is to receive it. We may add that his late position is now filled by Mr. W. J. Berry, till lately chief constructor at Malta.—*The Engineer.*

An appointment at the end of July was made of a committee to inquire into the use of oil for naval purposes, Lord Fisher being chairman, with Sir Philip Watts, Sir John Jellicoe, Sir Henry Oram, and Mr. A. F. Yarrow as prominent members. The errors in design and consequent delay in the completion of the *Lion* are understood to have been largely responsible for the changes made in the distribution of business at the Admiralty.

Within the next month great fleets will be assembled in the Mediterranean. In view of the situation created by the war in the Balkans the Admiralty are expediting their plans for reasserting British power in these waters. Not only has the third battle squadron, consisting of the eight *King Edwards'* arrived at Malta, but the battle-cruiser *Inflexible* and the armored cruiser *Warrior* are to proceed to the Mediterranean early in November as permanent additions to Admiral Sir Archibald Milne's command. By the end of the year the *Indomitable* will also have reached the Mediterranean, and we shall then have a force of eight battleships, two battle-cruisers, and four armored cruisers in those waters. In the past few days the six battleships of the third squadron of the French fleet have left Brest for Toulon, and practically the whole of the French fleet will this winter be concentrated in the Mediterranean, Admiral de Lapeyrère having under his command no fewer than eighteen battleships and six large armored cruisers. If we count the British battle-cruisers as swift battleships, which, of course, they are, the Double Entente will possess twenty-eight battleships and ten armored cruisers in the Mediterranean during the winter months. These forces should be sufficient to prevent the Mediterranean becoming the scene of serious trouble, for the Italian and Austrian fleets, even if—which is exceedingly improbable—they were ordered to combine, would be very inferior to the ships under the White Ensign and the Tricolor, *i. e.*, the *King Edward VII, Zealandia, Hindustan, Africa, Hibernia, Britannia, Commonwealth,* and *Dominion.*—*Naval and Military Record.*

ENGINEERING INSTRUCTION.—The Admiralty have decided that the Royal Naval Engineering College, Devonport, which has been closed for more than two years, shall be reopened on October 1, 1913, when the first party of "Lieutenants, E.," who joined the navy under the system of common entry inaugurated in 1902, will be transferred from seagoing ships to the college for a course of special training in engineering.

NAVAL GUN ACCIDENT.—A serious gun accident occurred on board the battleship *King Edward VII* off Colonsay on September 26, resulting in one man being killed and several injured. It is stated that the mishap occurred during firing practice, the breech-block of one of the larger guns being blown out and falling among a number of men.

SUBMARINE "B 2" SUNK.—The *B 2* was one of the older and smaller class of submarines, having been built, with 10 sister ships, between the years 1903 and 1907. Her length was 100 feet and her beam 12 feet 7 inches. Her displacement on the surface was 180 tons and submerged 210 tons. Her indicated horse-power was 600 on the surface and 150 below. Her engines developed a speed of 11½ knots on the surface and 8 knots submerged. She was fitted with two torpedo-tubes, and her complement was 2 officers and 13 men.

B 2 left Dover harbor about 5.30 on Friday, October 4, to participate in tactical exercises in the Channel. She was followed half an hour later by *C 16,* which was bound for the same destination as *B 2.* The latter was steaming on the surface with all navigation lights showing, and steering a course E. S. E., when she was run into by the Hamburg-American liner *Amerika* coming from the northeast. The liner struck the submarine just before the conning-tower, and probably cut her in two. She sank at once. The only member of the crew saved was Lieutenant Pulleyne, who was picked up by *C 16* after he had been swimming from half to three-quarters of an hour. Fifteen lives were lost.

The disaster was not witnessed by any of the other vessels of the torpedo or submarine flotillas, which had been exercising from Dover during that week. The liner appears to have stopped and lowered boats, and she afterwards proceeded on her course westward. The collision was not due to any mistake on the part of the submarine, which could have been seen some

distance away, as it was getting daylight. Lieutenant Pulleyne was brought to Dover and placed on board the cruiser *Forth* by *C 16*.

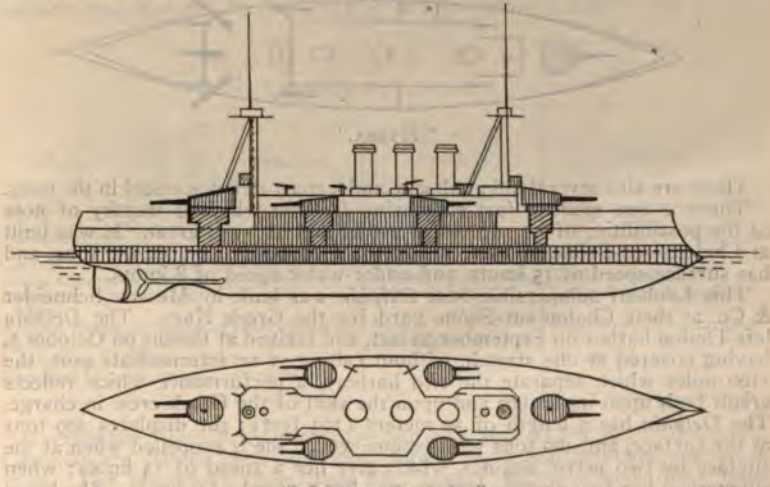
Searching operations were at once commenced by several vessels of the flotillas and by tugs from Dover. The naval authorities located the wreck on Sunday night, the sweeping gear of the destroyers *Leven* and *Fairy* catching it, whereupon divers were sent out from Dover for the purpose of going down to ascertain its exact whereabouts, notwithstanding the strong tide they succeeded in fastening a wire hawser to the submarine. Later, after attempts to raise her had been unsuccessfully made, the Admiralty definitely abandoned the attempt.

Lieutenant Pulleyne was on deck at the time of the collision, and the only other person there was a coxswain, but after the submarine was cut down Lieutenant Pulleyene did not see him again. The liner was going 18 knots at the time.

SUCTION AS CAUSE OF THE DISASTER.—Among naval men there is a very strong opinion that the disaster was due to suction. The enormous displacement of water by a 23,000-ton liner like the *Amerika*, they state, affects vessels of far greater size than a submarine, by influencing the steerage way. The tendency they say is very noticeable for torpedo-craft to veer towards larger warships owing to suction force when they are within a certain distance.

GREECE.

The Greek Navy, though less on paper than the Turkish, is in reality quite as powerful. Its ships are as a rule more modern and, rumor has it, in better shape as to training and personnel.



"GIORGIO AVEROFF."

The best Greek ship is the armored cruiser *Giorgio Averoff* of 10,000 tons, speed of 23 knots, launched at Leghorn in 1910. The main battery is four 9.2-inch guns, eight 7.5-inch, sixteen 3-inch, and three submerged tubes.

There are three small battleships, the *Hydra*, *Psara*, and *Spetsai*, built in France in 1892, and having several good points, not the least of which is their small draft, but 20 feet on a displacement of 5000 tons. M. Dupont, a young engineer, was their designer. Main armament is three 10.6-inch guns, five 5.9-inch and three torpedo-tubes.

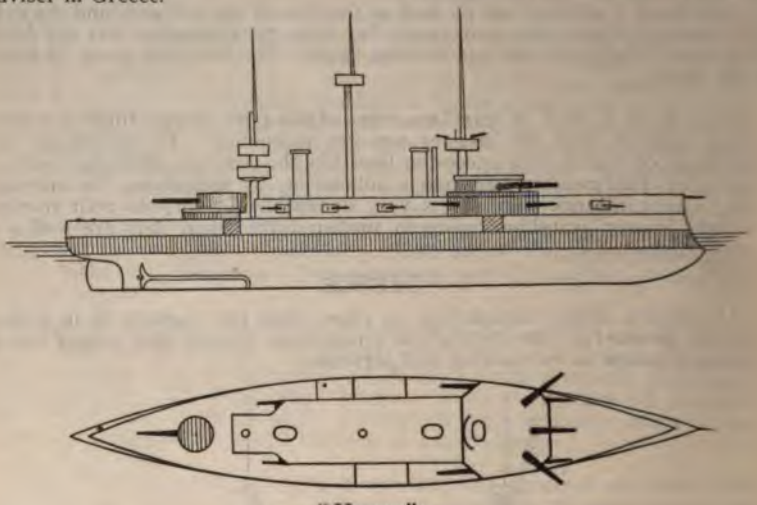
The unusual mounting of these guns is shown in diagram on p. 1654.

There are twelve good destroyers, four by Yarrow, four by Schichau, and the four of 950 tons built by Laird at Birkenhead, designed for the Argentine Government, but sold this October to the Greeks.

Also there has been ordered from Vulcan shipyard two large destroyers of 650 tons, driven by turbines and to have a speed of 32.5 knots.

The main base for the fleet is at Piræus, but there has been under construction at Salamine for two years a secondary base, the work on which has not advanced very far.

An English retired rear-admiral, L. G. Tuffnel, has been the naval adviser in Greece.



"HYDRA."

There are also several old gunboats, and a coast-defence vessel in the navy.

There is one modern fast submarine *Delphin* which is worthy of note as the possibilities of its successful use in this war are great. It was built at Chalons-sur-Saône in 1911, and is 164 feet long, displaces 450 tons, and has surface speed of 15 knots, and under-water speed of 8 knots.

This Laubeuf submersible boat *Delphin* was built by Messrs. Schneider & Co. at their Chalon-sur-Saône yard for the Greek Navy. The *Delphin* left Toulon harbor on September 30 last, and arrived at Piræus on October 5, having covered at one stretch, without calling at an intermediate port, the 1100 miles which separate the two harbors, a performance which reflects credit both upon its design and upon the skill of the Greek crew in charge. The *Delphin* has a length of 50 meters (164 feet); she displaces 300 tons at the surface, and 460 tons when submerged. She is propelled when at the surface by two petrol engines, which give her a speed of 14 knots; when submerged her two electric motors give her a speed of 9 knots. She has a radius of action of 1800 miles, and carries four torpedo-launching tubes on deck and one astern for 450 mm. (17.7-inch) torpedoes.

There are three mine-laying vessels of 3000 tons displacement.

On October 11 the government purchased the *Chao-Ho*, recently completed at Elswick for a Chinese training ship. She has a displacement of 2750 tons, and is armed with two 6-inch, four 4-inch, and two torpedo tubes.

BUDGET, 1912-1913.—The Greek shipbuilding program comprises work which will cover three years, and provides for the building of a sister vessel of the *Giorgio Averoff*, the reconstruction of the old armorclads *Spetsai*,

Psara, and *Hydra*, the purchase of two submarines, and the increase of the torpedo flotilla. The contract for the armored cruiser has been secured in Germany, which fact is likely to cause some disappointment in Italy. The *Averoff* was built at the Orlando yard, Leghorn, where the shipbuilding facilities have since been largely increased. She was a great success, and the fact that the contract for her successor has gone to a German yard is no doubt due to severe competition in price. It is believed that one submarine of the *Argo* type will be built in Italy, and another at the Germania yard. The amount to be expended on the torpedo flotilla is £360,000, and probably four destroyers of 650 tons, and six 200-ton torpedo-boats will be built. Two of the destroyers and the six torpedo-boats have been ordered at the Vulcan yard.—*The Army and Navy Gazette.*

Greek torpedo-boat No. 11 has sunk the 2700-ton armored corvette *Feth-I-Bulend*, in Salonica harbor.

HOLLAND.

The two Dutch colonial torpedo destroyers *Jakkhals* and *Bulhond* have been commissioned for service in the Dutch East Indies.

The Dutch surmarine *No. III* was launched July 30.

The four torpedo-boats building at Vlissingen and Rotterdam are named *Lynx*, *Hermelyn*, *Bos*, and *Panter*. The armored gunboats building at the government yard at Amsterdam are named *Brino*, *Friso*, and *Gruno*.

It is reported that a Dutch naval commission has visited England to contract for building four small *Dreadnoughts* for Holland of 17,000 tons displacement. The details are not yet known, but they are to have eight 12-inch guns that will be furnished by Krupp.—*Marine Rundschau.*

ITALY.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Cavour.....	22,000	22	13 12-in., 18 4.7-in.	Spezia	Launched Aug. 10, 1911
Giulio Cesare..	22,000	22	same	Ansaldo-Armstrong	Undergoing trials
Leonardo da Vinci	22,000	22	same	Genoa (Odero).	Launched Oct. 14, 1911
Andrea Doria.	25,000	23	13 12-in., 16 5.9-in.	Spezia	Laid down Mar. 24, 1912
Duilio.....	25,000	23	same	Castellamare	" " Apr. 30, 1912
Dandolo.....	28,000	25	10 14.2-in.	....	Projected
Morosini	28,000	25	same	....	"

BATTLESHIP "DANTE ALIGHIERI."—She was built at the Royal dockyard, Castellamare, having been laid down June 6, 1909, and launched August 8, 1910. The machinery, consisting of Parsons' turbines and Blechynden boilers, was built by Gio. Ansaldo, Armstrong & Co., Sampierdarena. Designed for a speed of 23 knots on 28,605 shaft horse-power, she developed 24 knots on 34,700 shaft horse-power, using forced draft and oil mixed with coal. The *Dante Alighieri* is of 21,000 tons displacement, 510 feet long on water-line, 85.3 feet beam and 28.5 feet mean draft. She mounts twelve 12-inch 46-caliber guns in threes in four turrets on center-line, the middle pair of turrets having no end-on fire; besides twenty 4.7-inch 50-caliber guns, eight in pairs in turrets and twelve in battery; sixteen 3-inch guns and three 18-inch submerged torpedo-tubes. The armor protection consists of a complete belt 9.8 inches thick amidships, tapering to 5.9 inches forward and 4.7 inches aft; 8.7 inches on sides of main deck amidships,

9.4 inches on turrets, 9.1 inches on barbettes and 3.9 inches on secondary turrets and battery. The forward conning-tower has 12-inch armor, the after one 7.9-inch armor and the deck sloping 2-inch armor.—*Shipping*, Illustrated.

During the week of September 11, 1912, the commissioning of the Italian battleship *Dante Alighieri* has been reported, 39 months from the date of laying down. So far as rapidity of construction goes, this is not a particularly good performance. There are many features about the Italian ship which call for comment. She is, of course, the first *Dreadnought*—properly so-called—to be completed for a Mediterranean power, though the French *Dantons* are generally regarded as *Dreadnought* equivalents. Again, the *Dante* is the first completed ship to be equipped on the triple-turret system, an idea which has since been adopted in the Austrian, Russian and United States fleets. No detailed reports of the gun trials of the Italian

ITALIAN BATTLESHIP "DANTE ALIGHIERI."

ship have been made public, but it is said that she came through them very successfully, and that the firing of the wing guns gave rise to no such turning movement in the turret as was in some quarters anticipated. Neither was there any reduction in the rapidity of fire. The speed performances of the ship, too, were noteworthy, for, although she was reported twelve months ago by *The Revista Nautica* to displace some 1200 tons more than the designed tonnage, the designed speed of 23 knots was exceeded on trial by a full knot, and that without pushing the turbines to their fullest power.—*Naval and Military Record.*

If the speed on her trials was, as is reported reliably, 24.5 knots, then the Italians have the fastest battleship afloat, and this is claimed by them.

Additional information concerning the trials of the *Dante Alighieri* states that on July 16 and 17 she maintained 21 knots for a period of 18 hours with fires in all of her 23 boilers and developed 21,000 horse-power instead of the contract requirement of 16,500 horse-power. The coal consumption was 700 grams per hour per horse-power, that is 200 grams less than stipulated. This 18-hour trial was immediately followed by a 6-hour forced-draft trial during which all auxiliary engines, including those for working the guns, were in operation. The maximum efficiency was a speed of 24.5

knots maximum and about 35,000 indicated horse-power. The engines were manipulated under varying conditions, and the backing turbines developed 14,000 horse-power. They also established in another run that the additional oil firing increased the horse-power from 16,000 to 25,000.—*Marine Rundschau.*

The *Cavour, Guilio Cesare* and *Leonardo da Vinci,* each of 22,000 tons displacement, have heavier armor than the *Dante Alighieri,* but lighter than the French and Austrian ships mentioned. These three ships will have the same speed as the *Dante Alighieri* and will be completed in September, 1913. The *Duilio* and *Doria* will be of an improved *Cavour* type and will be completed after a period of two years in building during the summer of 1914. They will have heavier armor and armament. Instead of 20 of 12-centimeter guns, they will carry sixteen 6-inch guns. The main battery of thirteen 12-inch guns will be mounted as in the *Cavour* class. They will also have fourteen 3-inch guns. Their length is 577 feet, beam 92 feet, draft 28 feet. Equipped with Parsons' turbines of 24,000 horse-power.

The Italian battleships *Dandolo* and *Morosini,* of the 1912-13 program, will be patterned after the American *Nevada* and *Oklahoma* class. They will mount ten 14-inch guns in four turrets, all in axial line, two of these mounting three guns each. The displacement will be 28,000 tons, speed 25 knots, and the secondary battery will consist of 6-inch guns. The indicated horse-power will be 49,000. The water-line armor belt will be complete, with a maximum thickness of 16 inches and will come up to the upper deck amidships. Moreover, the secondary or anti-torpedo battery, left unprotected on the *Nevada,* will be protected with 8-inch armor in the Italian ships. They will have no funnels and use liquid fuel. The new Italian gun for the *Dandolo* is reported as of being a 15-inch with a low initial velocity, firing a shell weighing 1653.5 pounds, and carrying 88 pounds of high explosive.

CRUISERS.—The protected cruiser *Marsala* will be completed in December, 1912, and the *Nino Bixio* in March, 1913. The sister ship *Quarto,* that is somewhat smaller, will join the fleet in commission in September, 1912.

The turbine cruiser *Quarto* made her trials satisfactorily. With 24-hour trial she made an average of 22.5 knots with 12,000 horse-power. The results of a 4-hour forced-draft trial were not published, the contract calls for 29 knots and 25,000 horse-power.

Two protected cruisers *Campania* and *Basilica* are being built at Castellamare for colonial service in the Red Sea to be completed by the end of 1914. These will be of 2600 tons displacement, 16.5 knots speed with great steaming radius. They will carry six 6.6-inch guns.

TORPEDO-BOATS.—There are 40 coast torpedo-boats building in private shipyards in Italy, 18 at Pattersons' works, Naples, 12 by Odero and 8 by Ansaldo at Genoa, all of which will use oil fuel and two are motor boats. Of these 13 are now in service. On their trials they made from 32 to 34 knots speed instead of the contract speed of 27 knots.

There are 10 destroyers building, 6 of the *Impavido* type and 4 of *Ardente* type. They have 700 tons displacement and carry one 5-inch and four 3-inch guns. The 6 destroyers of the *Impavido* type are fitted with the Tosi turbines. The *Indomito* made a speed of 36.1 knots on August 1 with forced draft, developing 17,000 horse-power, though only 30 knots were required by contract. The *Indomito* was built by the Societá Pattison, Naples, and she is the first of six Tosi turbine-driven destroyers which have been ordered from the Pattison Company for the Italian Navy. Her principal dimensions are the following: Length, 73 meters (239 feet 6 inches); breadth, 7.32 meters (24 feet); depth, 4.82 meters (15 feet 10 inches). There are two Tosi steam turbines, mounted in two separate

compartments, each driving a propeller. They develop together 15,000 shaft horse-power, and are designed to give the destroyer a speed of 30 knots. Five of these destroyers will be completed by the end of 1912, and the other five early in 1913. Italy then has 20 newer destroyers of from 400 to 700 tons and besides 43 efficient large torpedo-boats.

The torpedo-boat matériel has suffered considerably during the war and the supplementary appropriation of 15 million lire will be partly used to provide destroyers of over 900 tons displacement with oil fuel and 32 knots speed.

TORPEDOES.—The vessels now under construction will be armed with the 45-centimeter torpedo having a range of 4000 meters. Those succeeding will have the 53-centimeter torpedoes, the development of which is well advanced.

SUBMARINES.—Five of the eight submarines of the *Fiat* type, *Medusa, Beleda, Salpa, Argo,* and *Fisalia* are now in service. They made 14 knots surface speed on their trials. Two more of these will be completed in the spring of 1913. The *Nautilus* and *Nereide,* of 300 tons *Bernardi* type, will be completed by the end of 1912. The *G. Ferraris* and *G. Pullino,* 400-ton boats of *Cavallini* type, will be completed during the summer of 1913. The *Atropo,* 300 tons, *Germania* type, was delivered in September, 1912. This vessel, described on page 1137 of No. 143 of the PROCEEDINGS, has completed her first trials in the Bay of Eckernförde. The maximum speed was 14.7 knots, though the contract called for only 12. This was the mean of two runs over the measured mile. The Diesel motors are two cycle. By the middle of 1913, Italy will have 20 submarines. It is now proposed to build submarines of 500 tons displacement.

SUBMERSION TEST OF SUBMARINE.—The submarine *Squalo* was subjected to submersion test in Venice, July 29, and was submerged for 24 hours with her crew of 24 men without causing any injury to the health of the crew. This submerged endurance test was similar to that of the *Glauco* on June 14.—*Marine Rundschau.*

SUBMARINE SALVAGE VESSEL.—The Vulcan works, Germany, are building a submarine docking and wrecking ship that will be delivered in the summer of 1913.

NOTES ON NEW PROGRAM.—In view of the French shipbuiilding program Italy and Austria will be obliged to enlarge their shipbuilding program, especially since the annexation of Tripoli and Cyrenaica by Italy.

The new shipbuilding program does not provide for any battleship or battle-cruiser, but only protected cruisers of from 6500 to 700 tons displacement. These will have 6-inch guns, and vertical armor only in certain places with a heavily armored protective deck.—*Marine Rundschau.*

ANTI-AIR CRAFT PRACTICE.—The Italians conducted a series of 10 days target practice, firing against captive dirigible balloons which were towed along the coast by a torpedo-boat with lines of from 500 to 800 meters long at a distance of from 2 to 5 kilometers from the coast. They fired about 500 shells and shrapnel with tracer fuzes. In one case a balloon still floated in the air with two hits. The last practice was held in the presence of the Minister of War and Minister of Marine, two balloons of a volume of 15 to 25 cubic meters were destroyed by shellfire. One was hit at a range of 5000 meters. The guns used in this practice were mounted to permit an elevation of 75 degrees.—*Marine Rundschau.*

NAVAL ACADEMY.—In a competitive examination of candidates for naval cadets there were 400 candidates between the ages of 12 and 15 years, of

whom 284 were found physically qualified and 223 out of 227 passed the mental examinations, of these the first 50 were accepted and entered the Naval Academy.—*Marine Rundschau.*

OFFICERS RESTRICTED AS TO MARRIAGE.—An order issued by the Italian Navy Department on June 16, 1912, stating that all naval and army officers must have the consent of the King to marry, and that they must be over 25 years of age.—*Marine Rundschau.*

NAVIGATIONAL LAW.—The new Italian law requires all coal for the Italian Navy and Italian railroads to be imported from Wales in Italian ships. It is estimated that 700,000 tons will be required annually. The ships must carry 5000 to 6000 tons exclusive of their own bunker coal, for which they will receive a subvention of $60,000. The freight is fixed at $1.55 per ton for the first five years. The coal shall be imported from Cardiff, Barry Penarth, Talbot and Newport, and shall be delivered in 14 different Italian ports. This law is to continue in force for a period of ten years.—*Marine Rundschau.*

JAPAN.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Fuso.....	30,000	22	12 15-in., (?)	Kure	Laid down March, 1912
Battle-Cruisers					
Kongo.....	27,500	27	8 14-in., 16 6-in.	Vickers	Launched May 18, 1912
Hiyei.....	27,500	27	same	Yokosuka	" Nov. 21, 1912
Haruna.....	27,500	27	same	Kobe	Keel laid Mar. 16, 1912
Kirishima.....	27,500	27	same	Nagasaki	" " Mar. 17, 1912
Protected Cruisers					
Yahagi.....	5,000	26	6 6-in., 8 3-in.	Nagasaki	Delivered July 27, 1912
Hirado.....	5,000	26	same	Kobe	Commissioned June 17, '12

THE "SETTSU."—This vessel had her gun trials in Bungo Straits May 15. The official speed trials were also satisfactory, during these the *Settsu* made a maximum speed of 21 knots, while the prescribed speed was fixed at 20 knots. The ship was placed in commission on the same date, but placed in reserve to join the active fleet December 1, 1912.

"KAWACHI."—In the concluding paragraph of the article in the September issue, page 1141, on the Japanese battleship *Kawachi*, it was stated that the *Kawachi* was driven by Curtis turbines on three shafts, and the *Settsu* by Parsons' turbines on four shafts. Both these vessels, however, later advices state, are driven by Curtis turbines on two shafts.

DESTROYER.—The Japanese destroyer *Umikase* of 1150 tons has attained a speed of 33.46 knots on trial and is reported to be a very good sea boat. She is a good-looking vessel, and with her four funnels and semi-British appearance rather resembles the destroyers of the *Nubian* class. The trials of the sister ship *Yamakase* have also given satisfaction.—*The Engineer.*

MINE-LAYING VESSEL.—The Marine Minister has commenced to build a large mine-laying ship, *Sokuten Maru*, at the government yard in Maizuru which shall be completed early in 1914. This vessel is designed for service in the Pescadores Islands.

DRY DOCK.—The Sasebo dry dock is 777 feet long, 111 feet wide at bottom, with a depth of 38 feet over the keel blocks.

GUNS.—The guns for the *Kirishima* are being constructed by the Muroran Steel Works, in the Hokkaido, Northern Japan.

PROPOSED BUDGET.—The budget of 1913 is to contain thirteen large units, of which two are to be laid down in each year. Seven are to be super-*Dreadnoughts* of the largest type, mounted with 14-inch guns, and six will be powerful cruisers. Of these *Dreadnoughts*, five are to be built in the government dockyards of Kure and Yokosuka, whereas the other two are to be placed with foreign shipbuilders. The construction of the cruisers is to be effected in the private and government shipyards of Japan.—*The Marine Engineer and Naval Architect.*

The Japanese press published another argument by Paymaster Katagari for decreasing the personnel of the Japanese Navy. The number of the personnel is much greater than warranted by the tonnage and should be reduced. The naval budget of Japan is 35 per cent of all the government expenses and imposes a burden on the Japanese taxpayers twenty times greater than that proportionately borne in England.

MANEUVERS.—The Imperial Navy maneuvers were to begin on October 14 and to last up to November 10, terminating with a strategic exercise covering five days. Not less than 230 vessels were to take part. Admiral Dewa commands the Green fleet, representing the enemy, and Vice-Admiral Yoshimatsu the Red fleet, being the defending force.

FIRE ON THE "MIKASA."—K. Noguchi, a Japanese bluejacket with a grudge against the officers of the Japanese battleship *Mikasa*, Admiral Togo's flagship in the Russo-Japanese War, attempted to explode the magazine of the warship when she was lying at Kobe in October. He secured some gunpowder and combustibles and went into the ante-room of the magazine where the powder for the 12-inch guns was kept, with intent to start a fire and explosion, thereby committing suicide and involve the loss of the warship and many of the crew. Noguchi had fired his gunpowder in the ante-room and was lying dead as a result of the shock when four bluejackets ran in to find a heap of inflammable material burning, the fire working quickly toward the magazine. They hurriedly extinguished the blaze, and Noguchi's partly charred body was removed.—*Shipping*, Illustrated.

THE "NANIWA."—The Japanese attempts to re-float the *Naniwa*, which was wrecked some time ago, appear to have been abandoned. As the old cruiser was practically on the condemned list it is likely enough that the main reason the Japanese desired to salve her was a sentimental one. The *Naniwa* was the present Admiral Togo's ship at the time of the Chino-Japanese War. She fired the first shot in that war and this shot may be said to have been the foundation of the modern Japanese Navy.—*Engineer.*

NORWAY.

A new naval law was submitted to the Storthing in July providing $5,600,000 for the navy coast defence; $4,200,000 of this is estimated for building two coast-defence ships for defence of the coast at Bergen; $336,000 is estimated for building one submarine; $280,000 for torpedoes, and $168,000 for ammunition.

There is allotted for the defences and naval stations at Ofoten Fiord $252,000, at Christian Fiord (Horten cutoff) $196,000, at Bergen $112,000, at Christiansand $28,000 and Drontheim $28,000. In the discussion it was stated that the present defences had become obsolete and it was necessary to provide new defences so that the estimates could only be regarded as the first installments for the new defences that must be erected.

The Minister declared that in case of war between any of the great powers it would be obligatory to preserve the neutrality and prevent any violations of neutrality in the ports of Norway.* The defences at Christian Fiord were essential, especially to protect the Horten cutoff which was the available means of refuge for the Norwegian coast defence ships.

The desired naval shipbuilding program to extend over a period of years was not approved by the Storthing because they did not feel warranted to obligate future Storthing to the expenditures of a naval program.

Norway, now actively engaged in the reorganization of its long neglected fleet, has just placed an order with the Germania Krupp works at Kiel for the construction of a new submersible. This vessel will be delivered in 20 months and is an advance on anything now building. Three others are also under construction.

The last Storthing voted 20 million crowns for the modernizing of the fleet and coast defence. This sum will be used in the construction of two armored cruisers, fortifications near Narurk, and in the Christiania Fiord, and the building of naval bases at Bergen, Drontheim and Christiansand. Outside the above sum other credits will be voted for the national defence. According to the naval program the fleet will be increased by six new armored cruisers, six destroyers, about 40 torpedo-boats and 14 submersibles.—*Revue Internationale.*

PERU.

The armored cruiser *Commandante Aguirre,* formerly the French *Dupuy de Lôme,* sailed from the Lorient for Peru on October 15.

Dupuy de Lôme was a famous French naval constructor, who, in 1860, completed, in pursuance of an order of Napoleon III in 1858, the *Gloire,* the first iron-armored frigate to be built.

RUSSIA.

VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
Sevastopol	23,300	23	12 12-in., 16 4.7-in.	Baltic Works	Launched June 29, 1911
Petropavlovsk.	23,300	23	same	" "	" Sept. 9, 1911
Poltava	23,300	23	same	New Admiralty	" July 10, 1911
Gangut	23,300	23	same	" "	" Oct. 7, 1911
Emperor Alexander III	22,860	21	12 12-in., 20 4.7-in.	Ivan Bunge Co.	Building
Empress Marie	22,860	21	same	" " "	"
Catherine II...	22,860	21	same	Nikolaieff	"

SHIPBUILDING.—The large units of the program voted by the Duma have been ordered from the Baltic and Admiralty dockyards. Besides four cruisers of 6500 tons to be built in three years have been ordered. The program includes 36 torpedo vessels which ought to be ready by 1916, 12 being laid down each year.

* In this connection the article by Commander Hovgaard in PROCEEDINGS No. 137 will be found of interest.

Two cruisers of 3500 tons for artificers' schoolships will be built outside Russia.

The four armored cruisers which form part of the year's program will have a displacement of 30,000 tons, and will be built in shipyards at St. Petersburg, two at Galernis Island, and two at the Baltic yard. They will carry 14-inch guns, and will be laid down in spring of 1913.

The Duma adopted the small-ship building program. This is the first definite shipbuilding program modeled after the German practice that has been adopted by Russia. The advantages of a definite shipbuilding policy is thus becoming universally recognized as necessary.

The small-ship building program calls for a total of $258,000,000 (approximately) to be expended in the period from 1913 to 1917, with annual installments that must be appropriated each year by the Duma as follows: 1913, $58,000,000; 1914, $52,500,000; 1915, $52,500,000; 1916, $52,500,000; and 1917, $42,500,000.

(1) For the fleet there are $200,000,000 to provide, viz.: Four armored cruisers; eight small cruisers, four for the Baltic and two each for the Black Sea and Siberian fleets; 36 high-sea torpedo-boats; 18 submarines, 12 for the Baltic, and six for Siberian fleets; (2) $7,900,000 to provide for auxiliary ships; (3) $5,500,000 for floating harbor works; (4) $5,800,000 for Baltic works and Oubuchow yard; (5) $36,000,000 for harbor works at Reval, Cronstadt, Sveaborg, Sebastopol, Nickolajew and Vladivostock.

MILITARY PORT.—The Czar laid the corner-stone of the military port of Reval on July 12, 1912. This port is to be the advanced Russian naval base in the Baltic. The Czar designated the naval base as that of Peter the Great. It is estimated to require ten years to complete this.

THE "NOVIK."—The Russian destroyer *Novik* made 36.25 knots on her official trials last month. The vessel, which is 336 feet long by 31 feet 6 inches beam, is of 1280 tons displacement, and was built at St. Petersburg, the machinery consisting of A. E. G. turbines and oil-fired boilers, being supplied by the Vulcan Company, of Stettin. The designed speed was 35 knots with 36,000 shaft horse-power, but both have been considerably exceeded.

AVIATION.—An aviation station has been established at St. Petersburg where the navy has received two Curtiss hydroaeroplanes having a speed of 50 miles per hour, and a third Curtiss hydroaeroplane is expected having a speed of 54 miles per hour.

TURKEY.

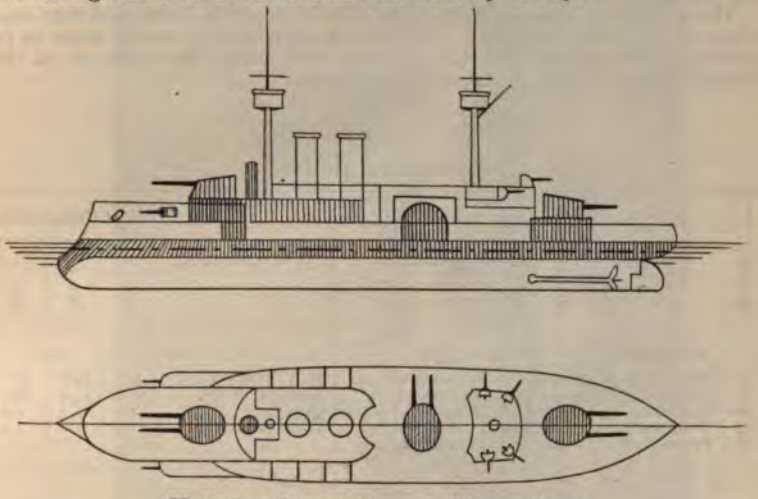
VESSELS BUILDING.

Name	Displacement	Speed	Armament	Builders	Remarks
Battleships					
*Reshad-I-Hamis	23,000	21	10 13.5-in., 16 6-in.	Barrow	Building
*Reshad V	23,000	21	same	Elswick	"

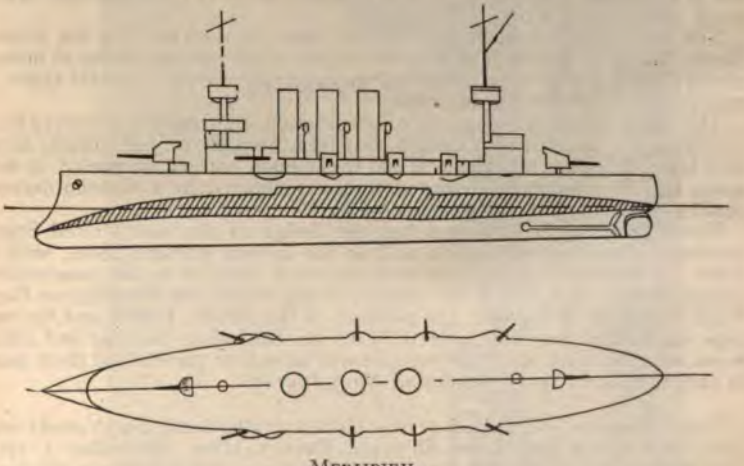
*Work on these vessels has been stopped and they have been advertised for sale. These vessels are 525 feet long, 27½ feet draft, horse-power of 31,000 tons, main armor belt 12 inches thick. They are quite well advanced in construction.

The two largest Turkish battleships are the *Kheije-ed-din Barbarossa* and the *Torgut Reis*, vessels of 9900 tons displacement and purchased from the German Government. These are well protected, carry six 11-inch, mounted in three turrets, eight 4-inch and eight 3.4-inch rapid-fire guns, and have a speed of 17 knots.

The *Messondiych*, built on the Thames in 1874 and reconstructed at Genoa in 1902, has a displacement of 9000 tons, and carries two 9.2-inch and twelve 6-inch guns, with a speed of 17.5 knots.* The cruisers *Hamidich* and *Medjidieh* are excellent modern cruisers of 4000 tons with speed of 22 knots, one having been built at Elswick and the other by Cramps.



HAIRREDIN BARBAROSSE AND TORGUD REIS



MEDJIDIEH.

Besides these there are two, the *Assar-I-Tewfik* and the *Muin-i-Zaffer*, the former of 5600 tons, the latter of 2400 tons, both old vessels.

* The battleship *Feth-i-Bulend*, reported on November 3 as having been sunk by a Greek destroyer, was a single screw vessel of 2800 tons, built at Blackwall in 1870 and reconstructed at Genoa in 1907. Armament was of four 5.9-inch and six 2.9-inch guns.

On page 727 of the June issue will be found a complete list of the Turkish Navy at the commencement of the Italian-Turkish War.

Their armament is two 9.2-inch, twelve 6-inch, and fourteen 3-inch guns. There are twelve large destroyers and twelve modern torpedo-boats, besides many gunboats.

The personnel of 31,000 men exists only on paper, it being said that one-sixth only is really available. The equipment generally leaves much to be desired. The training has been largely done under the direction of the English retired admirals, Gamble and Limpus.

UNITED STATES.

VESSELS BUILDING.

Number	Name	Displacement	Speed	Armament	Where Building	% of Completion		
						Sept. 1	Oct. 1	Nov. 1
	Battleships							
34	New York....	27,000	21	10 14-in., 16 5-in.	N. Y. Navy Yard	47.5	52.8	8
35	Texas.....	27,000	21	same	Newport News	71.6	73.9	76
36	Nevada.....	27,500	20.5	10 14-in., 18 5-in.	Quincy	1.2	1.3	1.4
37	Oklahoma....	27,500	20.5	same	Camden	1.3	2.0	3.3
38	Pennsylvania	31,000	23	12 14-in.				

THE "PENNSYLVANIA."—The new battleship *Pennsylvania*, authorized by act of Congress, August 22, 1912, is to cost, exclusive of armor and armament, about $7,425,000.

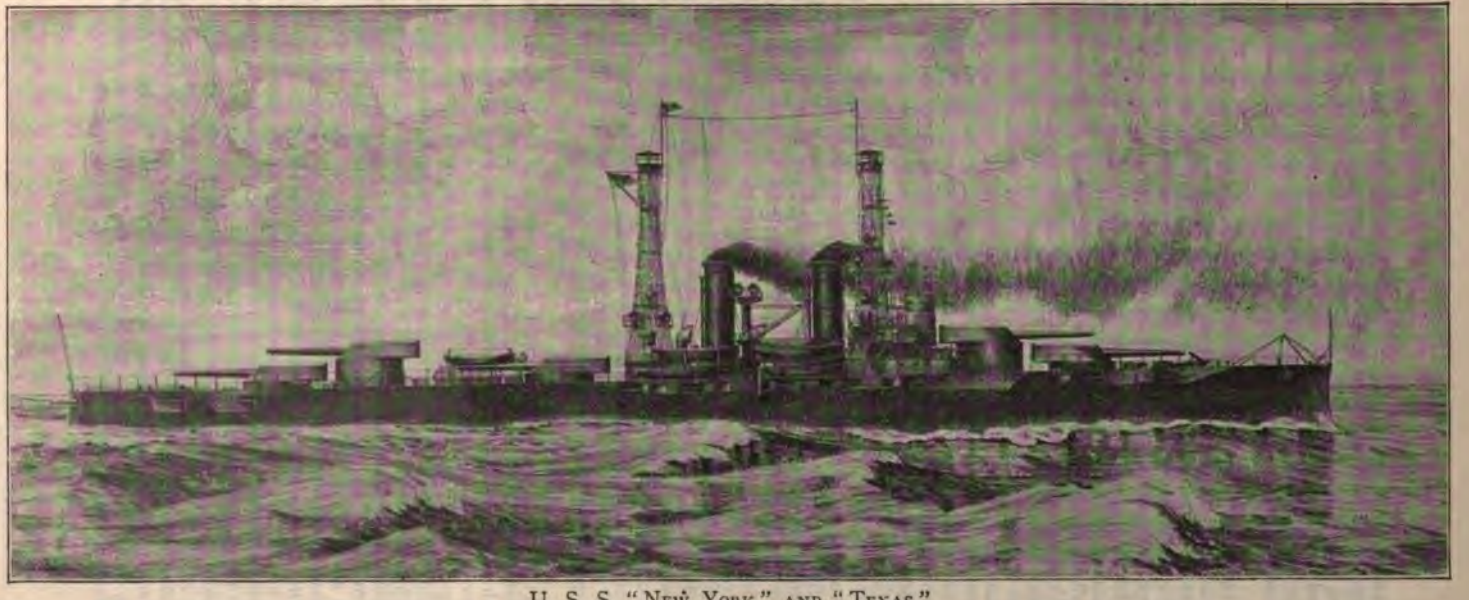
The vessel will be the largest of this class yet designed for the United States Navy. It will be heavily armored, its water-line belt being 16 inches, and will have oil-burning boilers of the water-tube type. Several types of machinery are under consideration.

The plans, which are in course of preparation, contemplate a vessel of the following characteristics: Length, 600 feet; breadth, 97 feet; draft, about 28.5 feet; displacement, about 31,000 tons; main battery of twelve 14-inch guns, and four submerged torpedo-tubes, supported by a torpedo-defence battery of twenty-two 5-inch guns.—*The Navy.*

Naval Constructor Robinson has the design of the new United States battleship *Pennsylvania*, which will be the largest warship afloat, well in hand. A model of her hull has been built and tested as to the comparative displacement, speed, etc., in the experimenting tank at the Washington Navy Yard. The cut of the bow, the position of the turrets, funnel and the two cage masts have been determined. Like the battleships *Nevada* and *Oklahoma*, now building, the *Pennsylvania* will have four turrets and three guns in each instead of two.—*Army and Navy Journal.*

THE "NEVADA."—The keel of the United States battleship *Nevada* was laid down in the Fore River Shipyard, Quincy, Mass., November 4, 1912. The *Nevada* will be 583 feet long and 95 feet beam, and will have a displacement of 27,600 tons. She will carry ten 14-inch guns in four turrets, besides a secondary battery. Her contract calls for delivery in January, 1915.—*Army and Navy Journal.*

THE "NEW YORK."—This vessel was successfully launched at the New York Navy Yard on October 30. Her principal dimensions are: Length, 573 feet; beam, 95¼ feet; draft, 28½ feet; displacement, 27,000 tons; speed, 21 knots; armament, ten 14-inch guns; twenty-one 5-inch guns, 19 of which



U. S. S. "NEW YORK" AND "TEXAS."

are mounted on the main deck, 10 being in a central battery protected by 6-inch armor. The remaining two 5-inch guns are mounted on the superstructure near the conning-tower. The water-line belt is of 12-inch maximum and is complete. A strake of 9-inch armor extends above this to the main deck. Transverse bulkheads are of 10-inch. Turrets are 12-inch. Reciprocating engines are to be installed.

THE GENERAL BOARD'S 1913 PROGRAM.—The 1913 program for new war vessels, as prepared by the General Board, calls for four ships of the same design as the *Pennsylvania*, with a speed of about 25 knots, and armament of twelve 14-inch guns, twenty-two 5-inch guns, and two submerged 21-inch torpedo-tubes. Oil-burning boilers are recommended.

Two battle-cruisers also will be asked for, with a minimum speed of 28 knots, and eight destroyers, having a length of 288 feet, breadth of 26 feet, and displacement of 742 tons, with a contract speed of at least 30 knots.

The United States Navy has at the present time no battle-cruisers. The auxiliaries asked for include two fuel ships, one hospital ship, one repair ship and one or two tenders for destroyers and submarines, together with supply and ammunition ships.

The recommendations of the General Board are based on the belief that a fleet of forty-eight first-class battleships, with the necessary supply of battle-cruisers and auxiliaries, is an imperative necessity for the protection and defence of this country and its dependencies.—*The Navy*.

THE "JUPITER."—This vessel was launched at the Mare Island Navy Yard, August 24. She will make about 14 knots an hour. She is 572 feet long by 65-foot beam; draws 27 feet 6 inches, displaces 19,360 tons and has a carrying capacity of 12,500 tons of coal and 375,000 gallons of fuel oil. The keel was laid October 16 last and the hull has been built in record time at a saving of nearly $100,000 over the appropriation of $1,200,000 allowed by Congress.

Power is supplied by a six-stage steam turbine engine of an American design, driving a 14,000 horse-power electric generator, the largest of its kind ever built. The current from this is conducted to motors driving twin-screw shafts.

Coal can be loaded from the *Jupiter* into a warship at the rate of 100 tons an hour and duplex pumps will permit her to take in or pump out oil to another vessel at the rate of 120,000 gallons an hour.

THE FLEET REVIEW.—The official list of vessels of the United States Navy, mobilized in the Hudson River at New York City from October 12 to 15, shows that 127 vessels of all classes and representing a total displacement of 741,500 tons took part.

Thirty-one battleships, 478,508 tons displacement; four armored cruisers, 58,000 tons displacement; four cruisers, 15,663 tons displacement; 20 special type, 55,373 tons displacement; six naval militia vessels, 4581 tons displacement; eight fuel ships, 88,385 tons displacement; 24 destroyers, 16,947 tons displacement; 16 torpedo-boats, 3029 tons displacement; 10 submarines; 123 ships of all classes, 720,486 tons displacement.

Besides the 1539 officers and 28,000 enlisted men of the navy and marine corps, there were about 108 officers and 950 men of the naval militia of various states filling vacancies on board vessels of the fleet.

The names of the several types of vessels that attended the mobilization, with the tonnage of each, are as follows:

Battleships.—*Connecticut*, 16,000; *Arkansas*, 26,000; *Wyoming*, 26,000; *Florida*, 21,825, *Utah*, 21,625; *Delaware*, 20,000; *North Dakota* 20,000; *Michigan*, 16,000; *South Carolina*, 16,000; *Louisiana*, 16,000; *Vermont*, 16,000; *New Hampshire*, 16,000; *Kansas*, 16,000; *Minnesota*, 16,000; *Idaho*, 13,000; *Georgia*, 14,948; *Virginia*, 14,948; *Nebraska*, 14,948; *New Jersey*, 14,948; *Rhode Island*, 14,948; *Missouri*, 12,500; *Ohio*, 12,500; *Maine*, 12,500; *Illinois*,

11,552; *Wisconsin*, 11,552; *Alabama*, 11,552; *Kearsarge*, 11,520; *Kentucky*, 11,520; *Iowa*, 11,346; *Indiana*, 10,288; and *Massachusetts*, 10,288; total displacement, 491,508 tons.

Armored cruisers.—*Washington*, 14,500; *Montana*, 14,500; *Tennessee*, 14,500; *North Carolina*, 14,500; total, 58,000 tons.

Cruisers.—*Salem*, 3750; *Birmingham*, 3750; *Chester*, 3750; and *Baltimore*, 4413; total, 15,663 tons.

Various types.—*Dolphin*, gunboat, 1486; *Nashville*, gunboat, 1371; *Petrel*, gunboat, 890; *Montgomery*, torpedo practice ship, 2072; *San Francisco*, mine-laying ship, 4083; *Mayflower*, converted yacht, 2690; *Yankton*, converted yacht, 975; *Dixie*, destroyer tender, 6114; *Castine*, submarine tender, 1177; *Severn*, submarine tender, 1175; *Tonopah*, submarine tender, 3225; *Prairie*, transport, 6620; *Celtic*, supply ship, 8000; *Culgoa*, supply ship, 6000; *Solace*, hospital ship, 5700; *Panther*, repair ship, 3380; *Lebanon*, ammunition ship, 3285; fleet tugs *Sonoma*, 1120; *Ontario*, 1120; *Patapsco*, 755; *Patuxent*, 755; *Machias*, gunboat, 1177; *Marietta*, gunboat, 990; converted yacht *Vixen*, 806; *Gloucester*, 786; *Wasp*, 630; and *Aileen*, 192; total, 66,584 tons displacement.

Destroyers.—*Smith*, *Lamson*, *Flusser*, *Preston*, and *Reid*, each 700; *Paulding*, *Drayton*, *Roe*, *Terry*, *McCall*, *Perkins*, *Sterett*, *Walke*, *Ammen*, *Burrows*, *Monaghan*, *Patterson*, *Trippe*, *Fanning*, *Jouett*, *Beale*, and *Jenkins*, each 742; *Worden*, 433; and *Macdonough*, 400; total, 18,431 tons.

Torpedo-boats.—*Tingey*, 165; *Craven*, 146; *Shubrick*, 200; *Thornton*, 200; *DeLong*, 196; *Stockton*, 200; *Dahlgren*, 146; *Bailey*, 280; *Bagley*, 175; *Barney*, 175; *Biddle*, 175; *Stringham*, 340; *Porter*, 165; *Blakely*, 196; *Dupont*, 165; and *Morris*, 103; total, 3029 tons.

Submarines.—*C 1*, *C 2*, *C 3*, *C 4*, *C 5*, *D 1*, *D 2*, *D 3*, *E 1*, *and E 2*.

Fuel ships.—*Orion*, 19,132; *Cyclops*, 19,360; *Sterling*, 5663; *Vulcan*, 11,230; *Hector*, 11,230; *Cæsar*, 5920; *Brutus*, 6600; and *Ajax*, 9250; total, 88,385 tons.

ACCIDENT ON THE "WALKE."—On October 1, 1912, while preparing for her second quarterly speed trials, the port turbine casing blew up, killing Lieutenant D. P. Morrison and four men. This is an unprecedented accident in the engineering experience of the service. The *Walke* is a destroyer of 742 tons and was built at the Fore River Shipbuilding Company at Quincy, Mass. The propelling machinery consists of two sets of Curtis turbines of 12,573 horse-power. The cause of the accident as determined by the court of inquiry has not been made public.

ORDNANCE AND GUNNERY.

GUNS AND PROJECTILES.

THREE-GUN TURRETS.—Three-gun turrets are not in favor in Germany. Recently a three-gun turret for 12-inch guns was built, and the trials, kept secret, were far from successful. It is said that the three guns could not fire as many shots as two guns in an ordinary turret. Moreover, the confusion among the gunners was extreme, resulting in a very slow rate of fire. To obviate this, the men were carefully drilled without obtaining much better results. Therefore, the commission studying this type of turret has pronounced against it.—*Le Yacht.*

The Chief of the Bureau of Ordnance announces that the three-gun turret for the new battleship *Nevada* has stood a satisfactory test at Indian Head. As the development of this new style of turret involves some very intricate problems which the Ordnance Bureau has solved, the Navy Department naturally is determined to keep the details secret until the work of installing the new turrets has actually been started.

The Austrian battleship *Viribus Unitis* and the Italian battleship *Dante Alighieri* both have been recently commissioned, and illustrations showing

the triple turrets are produced elsewhere in this issue of the PROCEEDINGS. It is known that the Austrian mount has all three guns working in a single sleeve elevating and training all at the same time.

FOUR-GUN TURRETS.—Although the French had completed a design for these, late advices indicate that they will not be installed.

GERMAN GUNS.—The *Goeben* is the first ship to carry the new 50-caliber 11-inch B. L. This guns weighs 41½ tons, or 2½ tons more than the 45-caliber model mounted in the *Moltke*. It fires the regulation 760-pound shell, but the powder charge is increased to 262 pounds, the initial velocity to 3201 f. s., the muzzle energy to 43,564 foot-tons, and the muzzle penetration of steel to 37 inches. The muzzle penetration of the 45-caliber 11-inch B. L. is 35 inches. The rate of fire from the new gun is 1½ shots per minute, counting from the moment of discharge and reckoning only carefully

GERMAN CRUISER OF THE LINE GOEBEN.

aimed shots from a moving ship. The entire powder charge is in a brass case, a method which, as experience has shown, does not tend to expedite loading. In the 45-caliber 11-inch B. L. the charge is in two sections, only the second being cased. There is reason to believe that the cartridge-case system for heavy gun charges will shortly be abolished in Germany, as there are complaints both as to the extra expense and weight involved. On the grounds of safety in storage and handling the brass envelope has some claim to recognition, but otherwise its utility is by no means so great as is popularly supposed. Germany and Austria are the only two powers which still adhere to this system for big guns.—*Naval and Military Record.*

NEW AUTOMATIC MILITARY RIFLE.—A new automatic self-loading infantry rifle, invented by Mr. Franklin K. Young, of Boston, has been examined by a board of ordnance experts of the army, who think so highly of it that Col. S. E. Blunt has approved a recommendation that the United States armory at Springfield be authorized to construct rifles on this model. The *Boston Globe*, describing this new rifle, says, in part:

"Its features are, briefly, that the barrel is set immovably into the frame, the bolt is locked into the rear of the barrel, the loading mechanism is

operated by the standard ammunition in use in the service, it is the only automatic rifle to have a single-shot action, it takes nothing from the perfections of the present military rifle, but adds the automatic firing feature.

"This automatic feature can be applied to sporting rifles, pistols, machine guns and light field guns for the artillery. Such a machine gun would weigh fifty-five pounds complete and would have a firing capacity of sixteen shots per second or 960 shots per minute. Applied to field guns, their weight would be reduced to two-fifths their present bulk, and guns using an eight-pound projectile would have a firing capacity of 120 shots per minute.

"The new rifle invented by Mr. Young possesses the qualities of automatic reloading, the ejecting of the old cartridge, and the breech bolt is securely locked until the bullet has left the bore. In case of misfire or jamming the chamber is more easily freed than in the present service rifle.

"The new weapon weighs only 10 pounds 2 ounces; its parts are interchangeable and readily replaced, and the present service rifle can be quickly and inexpensively converted into automatics of this model, it is claimed. The official report to Brig.-Gen. William Crozier, Chief of Ordnance, U. S. A., states that it will be 'serviceable, endurable and efficient.'

"The rifle is so constructed that each shot is controlled by the will of the user, or, in other words, it fires only one shot at the pull of the trigger, but the speed of operation is normally equal to that of the machine gun, the inventor claims.

"This rapidity of fire, while desirable, is by no means the chief value of the automatic rifle. Its chief advantage lies in the relief from fatigue afforded the soldier through his not having to operate the loading mechanism by hand.

"To illustrate this point it may be said that the infantry rifle of to-day requires four separate movements before the soldier is ready to sight and fire. The labor of loading increases as the bolt becomes heated and fouled. In other words, if the soldier fires 400 shots he makes 1600 movements of his hand, excluding the pulling of the trigger. With the new rifle Mr. Young has invented the 1600 movements are reduced to zero.

"By the use of the new rifle a soldier has always two shots available against one of his enemy's, and he can have a third shot by inserting a cartridge by a single movement. To fire three shots in return his enemy must make eight separate movements, supposing his rifle has a cartridge in the chamber to start with."—*Army and Navy Journal.*

ILLUMINATING SHRAPNEL.—The *Artilleristische Monatsheft* states that the Italians have successfully experimented with the Toccacielo illuminating shrapnel. This shrapnel was fired from a 6-inch gun at the naval proving grounds at Via Reggio, April 11, 1912. The target was anchored at sea and the exploding shrapnel illuminated the area around the target long enough for repeated aimed shots to be fired at the target. The area illiuminated was that of a circle of approximately 500 yards radius. The test proved not only the efficiency of the illumination, but that the position on shore at the gun was not revealed during the firing that night. The exact time in seconds that the area remained illuminated was not given.

EXPERIMENTS WITH DELAYED ACTION H. E. FUSES.—In the latter part of September off Cherbourg some interesting high-explosive shell and fuse trials took place against the old *Neptune*. Plates of armor similar to side armor of battleships were secured on board, and the firing was done from a shore battery. The new armor-piercing shell of 6.4-inch caliber fitted with a special fuse was fired at the plates from 450 yards distance. The shell penetrated the plate and detonated behind it. The gas and pieces would have produced great damage in the interior of a battleship. The battery also fired shell of 9.6-inch caliber. The latter detonated beyond the plate and sent pieces in all directions for five-eighths of a mile. Very little exact information is procurable. The French, however, seem convinced that they

have a perfect high-explosive fuse, and that the problem of bursting mélinite shells in the interior of armored and unarmored vessels at all battle ranges is solved. In these experiments various velocities were used so as to represent the battle ranges, the short range adopted for the tests being due to the desirability of hitting the steel at the point desired.

HADFIELD CAST-STEEL PROJECTILES.—The letting of a small part of the contract for shell to the Hadfield Foundry Company, of Sheffield, England, by the Navy Department is to determine the quality of this particular make of English projectile. Price is an important consideration, of course, but

The Army and Navy Gazette.

FIG. 1.—EHRHARDT GUN.

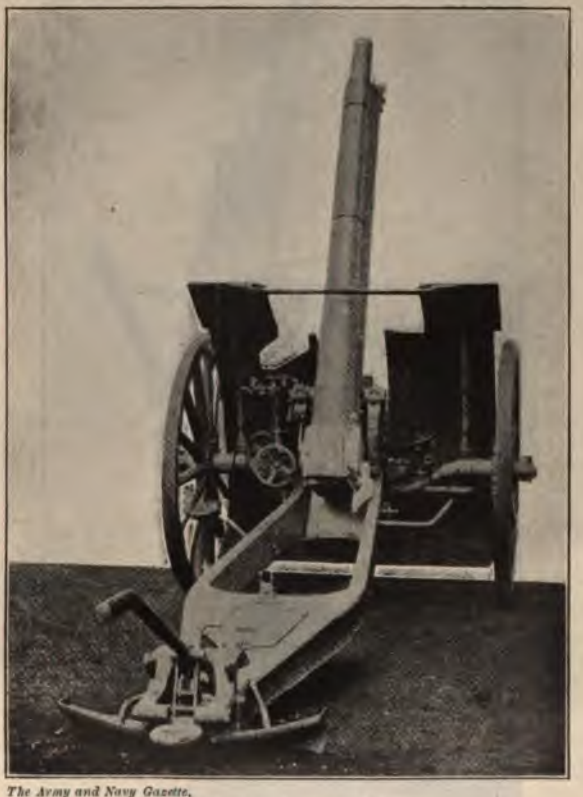
to sacrifice the effectiveness to save the difference between the cost of American and English shells would not only be an unwise, but a dangerous economy. The claim is made by the Hadfield concern that it has a superior and cheaper process of treating steel for projectiles. Already some small contracts for Hadfield projectiles have been filled in this country. This is arranged by paying a royalty to the English concern.—*Army and Navy Register.*

ENGLISH ANTI-AEROPLANE GUNS.—A gun firing a 31-pound shell and having a long height range, with an extreme elevation of 80 degrees, is to be furnished the new British warships.

ANTI-AIRCRAFT GUNS.—The gun invented by Ehrhardt of Düsseldorf is the most effective and practical one to date, and it has been finally adopted

by the German Government after careful experimentation. There are several models of this gun of various calibers from 1.96-inch to 4.13-inch. Figures 1 and 2 herewith show his gun of 2.95 inches in caliber mounted on a field carriage.

The greatest range of this gun is 10,661 yards or about 5¾ miles. The greatest elevation is 70 degrees, at which the projectile reaches the height of 7435 yards or nearly 4¼ miles, considerably higher than is the usually attained altitude of aircraft.



The Army and Navy Gazette.

FIG. 2.—EHRHARDT GUN.

A much more powerful weapon is Ehrhardt's 4.13-inch gun, whose longest range at an elevation of 43 degrees is 12,992 yards, or very nearly 7½ miles, its highest altitude of 4319 yards being reached at 4¼ miles from the firing position. This gun can be elevated to 70 degrees, when its projectile rises to 9077 yards, or over 5 miles, which is about twice the height hitherto attained by any airman. This gun, also, can be mounted on a field carriage.

The mounting of such guns on field carriages has this advantage that they can also be used as ordinary field guns; but as they would thus be drawn by horses, and consequently could not move so rapidly as aircraft, Ehrhardt has devised a special motor carriage. This anti-aircraft gun, on a cone-mounting, can be fitted to the deck of a war vessel of any kind, and was so

fitted in the tests made in the German Navy, Fig. 3, especially a destroyer—which at sea would correspond to the motor carriage of the gun on land. Such a mounting has this advantage, that the gun, being pivoted on its center, can be rapidly swung round, either by the laying gear, or by hand, the latter being of the greatest importance in a heavy swell.

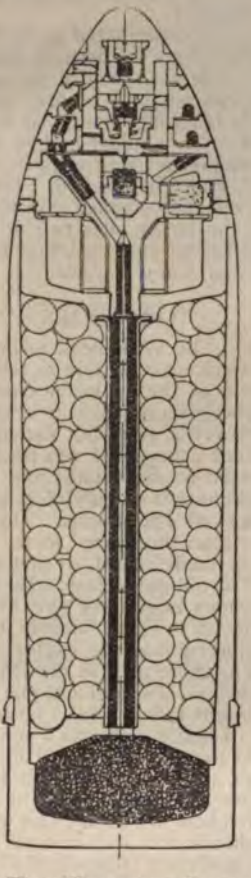
The Army and Navy Gazette.

FIG. 3.—EHRHARDT GUN.

Very ingenious is the sighting mechanism of the gun. Errors arising from drift, or difference of wheel level, can be quickly rectified. The range is ascertained either by judging the distance or, better still, by a modern range-finder, which has now been brought to such perfection as to make it possible to obtain the range with the greatest accuracy in the shortest possible time.

This found, the range is conveyed to the gun-layer, who adjusts the distance scale of the sighting mechanism accordingly, and has then nothing to do but to cover the aircraft with the telescope. The action of moving the spy-glass at the same time also adjusts with perfect accuracy the gun's aim.

But the air vessel moves rapidly, and the gun must be able to adapt itself thereto, or, in other words, the bursting point of the projectile must be rapidly changed. This is effected by an automatic fuse-setting key, which



EHRHARDT'S HIGH-EXPLOSIVE SHRAPNEL SHELL.

permits of slight alterations in the bursting time of the composition ring simply by thumb pressure.

The projectile used against aircraft is not a simple shrapnel, but is a combination of shell and shrapnel with corresponding double action.

It is a high-explosive shrapnel, of which Ehrhardt and Captain Van Essen are the inventors, and is admittedly the most perfect thing of its kind. The body of the projectile is shrapnel, while the head, or nose, carrying the second fuse and containing a high-explosive charge, follows the shell portion. The time fuse ignites the bursting charge in the base of

the shrapnel, which sets free the bullets and throws them forward with tremendous force.

The explosion of the bursting charge, however, detaches the shell-head from the shrapnel body, causing it to shoot forward, as a separate projectile, for some 130 yards, when its high explosive contents burst with a force strong enough to overturn a field gun and ammunition wagon.

The result of it all is that the exploded fragments and bullets of five of these shell-shrapnel projectiles—fired with Pom-pom like rapidity—bring certain destruction to anything within a tubular air space of 700 yards long and over 300 yards in diameter.

The double projectile is so constructed as to develop a cloud of smoke, to show the gunner whether there is anything amiss with his aim, which he can then rapidly correct. The shell part of the projectile is especially dangerous to dirigibles, as it can set them on fire; while, if the mere explosion of such a terrific projectile is strong enough, as it is, to overturn a field gun, what is likely to be its effect on a spider-bodied aeroplane?

Ehrhardt's guns are unique in being constructed from a solid block of the best procurable steel, mandril punched. This method compresses the material and renders it extremely strong. Smaller guns are made of single tubes, but in the case of the larger ones two or more tubes are employed, and by this same process Ehrhardt claims that he can make cannon of the heaviest caliber.—*Army and Navy Gazette.*

TORPEDOES.

AUTOMOBILE TORPEDOES.—The Whitehead torpedo is now almost the only one in the field. The torpedo is now able to take its place as the equal of the gun. The development of the explosive charge is the result of explosion experiments made partly on actual war vessels and partly on caissons of smaller size, which, however, were not damaged to the same degree as larger objects. The earlier charges of 200 pounds to 250 pounds of explosive material have grown to 260 pounds and 330 pounds. The original Whitehead torpedoes had charges of only 66 pounds, and those used in the Japanese War had charges of 132 pounds. The weight of the charges is now 150 per cent greater than those used in the last-mentioned war. The old pointed heads are now made round, so that the charges explode closer to the points of attack. The old gun cotton, with its specific gravity of 1.2 to 1.3, has given way to various explosives won from coal tar and having a specific gravity of about 1.6. These include picric acid, called lyddite, shimose, etc. It is considered that the explosive value of the charges is now three times as great as those used in the Russo-Japanese War. Meanwhile ships have increased in size and become relatively less vulnerable. One hit with a torpedo might fail to sink a large warship, but it will compel her to leave the line of battle, whereas a second hit will probably complete the work. Torpedo nets are now used by every country, except the United States of America, where it is probably thought that they would be of no avail against the new Davis weapon. The Bullivant net as fitted in a large English warship weighed 100 tons. The weights built into vessels in the form of division bulkheads, etc., for the same purpose were even greater. If necessary, the charges and their effects could be still further increased.

With regard to range, the 21-inch English torpedo, Mark II, is said to run for 10,000 to 11,000 yards, and it probably has an effective range of about 6560 yards, and the weapons of other nations would probably shortly do much the same. This range is sufficient, but practical trials must decide whether further improvements in the motor should be devoted to increase of the speed. The motor used was the Brotherhood compressed air engine. From the original 328 yards the range has been first increased to 875 yards, then gradually advanced to 2187 yards, and finally to 3828 yards, by improvements in the material and increase of the size of the air vessel accompanied by the adoption successively of the three-cylinder and four-cylinder engines. An apparatus is now inserted which heated the air before use. Attempts are now being made to replace the Brotherhood engine by a

turbine, and this or other motive machinery would probably further increase the performances already attained.

As regards steering, the maintenance of a desired depth below the surface is now satisfactorily accomplished. The uncertainty of aim due to imperfect knowledge of the speed of the enemy, can be reduced by increase of speed of the torpedo, but not avoided. The actual deviation from the course given by the direction of the tube is reduced to about 1 per cent of the distance travelled by the introduction of the gyroscope, which, by means of the Anschütz patent, was now made to act continuously during the run. The Davis torpedo was the invention of Cleland Davis, dated from 1908, and differs from the Whitehead in carrying a gun at the head. Whereas the Whitehead charge exploded in the open water and took effect on the outer parts, the Davis gun shot the charge into the vessel to explode inside. The extent of the damage resulting would probably be less, and would vary with the angle of the gun at the moment of discharge. There is no doubt that the Davis gun-torpedo can be made into an effective weapon. The torpedo was the deciding factor in the design of the submarine boat. Russia is building destroyers with 10 torpedo-tubes, and France has boats with 11 tubes.

The early future will see much more attention paid to the torpedo in large war vessels. The "torpedo ram" has come to life again. Russia is said to be building a submarine cruiser of 5400 tons displacement with 36 torpedo-tubes and 60 torpedoes.—Extracts from "The Development of the Torpedo," by Captän zur See S. Michelsen, Kiel.—*The Engineer.*

FIRE CONTROL.

CONNING- AND FIRE-CONTROL TOWERS.—Two photographs of these as installed on the battle-cruiser *Lion* and the battleship *King George V* are reproduced on the following pages.

The conning-towers of the recent English battleships are unusually large in order to provide space for the gunnery lieutenant or fire-control officer of the battery as well as the torpedo fire-control officer with all the instruments necessary.

Forward, the tower, due to a combination of the vertical armor, the armored deck, and the base of the 13.5-inch gun turret, is absolutely sheltered from direct impact of heavy shell. It is hoped these will glance from the oblique and curved armor surfaces presented.

THE FIRE-CONTROL POSITIONS.—The experiments which have recently been carried out on board the battleship *Thunderer*, in the vicinity of Bantry Bay, appear to have proved beyond doubt that in future ships, a more suitable place will have to be found for the fire-control instruments and their operators. During some periods of the trials the control position, we understand, became almost as hot as an oven, the operators being parboiled while carrying out their highly important functions. It seems that unless the ship is steaming against a strongish head wind it is next to impossible for the fumes and smoke from the foremost funnel to be carried clear of the men and instruments in the control position. As in action the course of a ship is constantly being altered, to obtain the weather gauge of an enemy and thus place the sun behind the sights of the gunlayers to prevent them having to fire at an object in the sun's eye, the wind naturally blows the smoke and fumes from the funnel straight at the control position for the better half of the time. That this would interfere with the efficient use of the instruments is very obvious, and consequently the gunfire would suffer from the lack of adequate control during that period. The sum spent on effecting alterations in the *Lion* was a very large one—about £50,000—but it is better to spend money for the purpose of making a ship capable of doing her best under all conditions, than to send a capital ship into action whose gunfire cannot be properly controlled because of the smoke and fumes from the funnel. These remarks appear to be specially applicable to the *Thunderer.—United Service Gazette.*

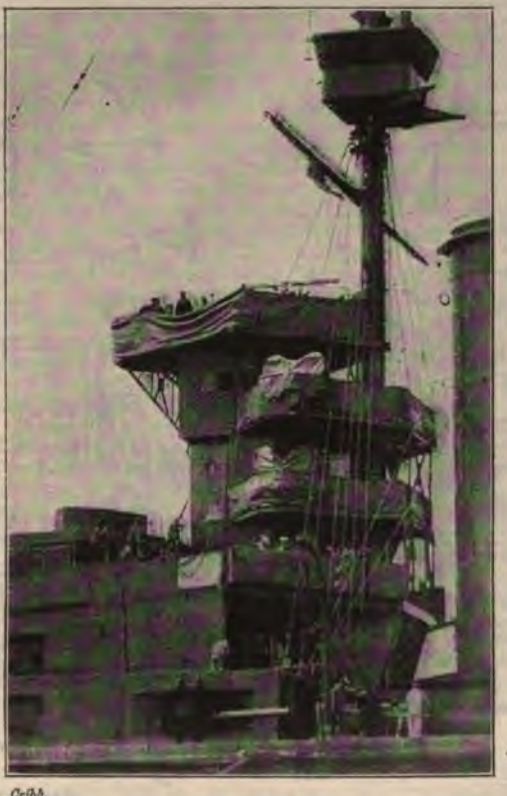
Cribb.

"KING GEORGE V."

FIRE-CONTROL TOWER, TOP, IMPROVED TYPE CONNING-TOWER.
Note the Pole Mast, and Small Wireless.

SPOTTERS' STATIONS.—After the trials on the *Posen* the Germans are installing on board battleships a spotter's platform at the masthead from which to control the fire.—*Moniteur de la Flotte.*

SCOTT'S FIRE DIRECTOR.—The object of this is to rapidly concentrate the fire of all the available guns of large caliber on the broadsides, and then deliver a rapid succession of crushing blows on the hull and fittings, the armor and turrets of the enemy. Salvos and broadsides, when the latter



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H. M. S. "LION."

The conning-tower and spotter's top.

are possible, are used for this purpose, but the gun-fire is so arranged that the smoke from one gun shall interfere as little as possible with the fire of its neighbor, and this is not an easy matter, but one which requires to be arranged by careful thought and on scientific principles, and this is the first time a solution has been found for the handicap that smoke and blast invariably impose. A ship in action is likely to have the wind from all directions by the varying of the ship's course when maneuvering for the best position, and this causes smoke obstacles, which if not scientifically overcome, places half the armament out of action for quite half the time. The Scott system is intended to remove this handicap as much as possible.

During the latter half of last century, when muzzle-loading rifled guns, carrying to a long range, came into play, broadside firing was also brought to a higher standard of accuracy by means of electrical apparatus for firing and improved means of concentrating the guns. During the last few years the improvement has continued in the means of accurately finding the range; but concentrating guns and broadside fire has remained more or less stationary. By the new Scott method broadside fire is once more raised to a high point of efficiency, and a stunning blow can be dealt out to an enemy

The Fleet.

AN ENGLISH CENTRAL STATION.

THERE ARE OTHERS!

at 10,000 yards. In fact 20 to 30 per cent of gunnery efficiency has been added to naval guns, under this plan of concentration, at a single bound. There is no competition between Sir Percy Scott's apparatus and the old methods, because the former is chiefly adventitious aid to the gunlayer, whereas the Scott arrangement deals with concentration and a smashing broadside blow.—*United Service Gazette.*

The battleships *Orion, Monarch, Thunderer,* and *Neptune* are the ones so far fitted with this apparatus.

DIRECTOR TESTS ON THE "THUNDERER."—Advices to hand relative to the trials which took place in September with Vice-Admiral Sir Percy Scott's "fire director," fitted in the battleship *Thunderer*, confirm the tests made originally in the battleship *Neptune*, as to the accuracy of fire obtained by the use of the invention.

Those who were responsible for carrying out the trials speak in terms of high praise of the new instrument which renders it possible to begin an action at over 10,000 yards, with the certainty of hitting, thus rendering the secondary armament of possible rivals virtually ineffective. It is not too much to add that the introduction of this scientific aid to straight and rapid fire means 20 to 30 per cent increase in efficiency.

The important firing trials of the main armament of the battleship *Thunderer* controlled by the new Scott fire director were supplemented by a series of comparative experimental trials in heavy weather, in which the *Orion*, *Thunderer*, and *Monarch* were engaged. Each of these battleships is provided with range-finding and fire-control instruments, and carries a similar armament to the *Thunderer*, viz., ten 13.5-inch guns mounted along the center line; hence the trials, in which the capabilities of the new fire director as compared with the latest ordinary range finders were exhaustively tested, are considered to be the most important since the introduction of the all-big-gun type of ship.

The trials took place in heavy weather, vessels rolling over 5 degrees.

Accuracy of Fire Unprecedented.—During the last few days most interesting experimental tests with Vice-Admiral Sir Percy Scott's "fire director" have been made on board the battleship *Thunderer*, which was recently sent to Berehaven for the purpose of calibrating and making confidential trials with the "director." Four broadsides were fired and the accuracy of fire is reported to have been unprecedented.—*Naval and Military Record.*

The *Thunderer* fired four times, and each time she went out from Bantry Bay other ships accompanied her and did battle practice, so as to enable a direct comparison to be made of firing under similar conditions of wind and weather. The actual results are kept secret, but it is known that the "director" system was a great success. The *Thunderer* fired broadsides, generally of five guns, but sometimes of ten, and the target was left in a battered condition.

The *Thunderer* and *Orion* then fired simultaneously at different targets, so as to ascertain which vessel could make the most hits in a given time, and thus tested the relative merits of the director and fire-control systems.

The *Orion* carries the fire-control equipment which was adopted by the Admiralty some years ago and has helped largely towards bringing about the present standard of gunnery efficiency in the British fleet.

The *Orion*, which now bears the flag of Rear-Admiral Rosslyn E. Wemyess, has proved to be a good gunnery ship, and has also the advantage of having been in commission over ten months, whereas the *Thunderer* was not commissioned until June 15—an important difference in a matter which depends largely upon the gunnery department of a ship's company.

The trials were carried out in the presence of five flag officers, viz., Vice-Admiral Sir John Jellicoe, in the *Hercules*, flagship of the second squadron; Vice-Admiral Sir Percy Scott, in the *Thunderer;* Rear-Admiral Rosslyn Wemyss, in the *Orion*, flagship of the second battle squadron; Rear-Admiral Sir George Warrender, in the *Indomitable*, flagship of the second cruiser squadron; Rear-Admiral Montague Browning, inspector of target practice; and Rear-Admiral R. H. Peirse, a former inspector of target practice.

No results have been given out, but it is known that the salvo dispersion due to errors impossible to eliminate indicated in the firing, made neither system seem better than the other.

In the rough weather tests, however, the *Thunderer* made five times as many hits as the *Orion*, and completely eclipsed all previous records of

firing, including those obtained in fine weather. Her broadsides, sometimes from five and sometimes from ten guns, seemed to rain on the target.

FRENCH FIRE-CONTROL NOTE.—French battleships are now having the Janney system of pointing fitted to their guns, and the Leconte-Aubrey instruments for fire control installed. Details of these systems are not known.

THE SKELETON MAST TESTS.—A test mast was erected on the *San Marcos* and inclined at 15 degrees from the vertical and the top weighted considerably. About thirteen 12-inch high-explosive shells were fired and the lattice work damaged severely. The mast fell finally, all its elements being cut. The target presented by the mast is not one-tenth of that presented by a battleship, hence a ship would be hit 120 times before the mast would fall. That the result of the test is considered satisfactory is indicated by the fact that the *Pennsylvania* will have cage masts of the standard service type.—*Moniteur de la Flotte.*

POWDERS.

FRENCH POWDER INQUIRY COMMITTEE.—The committee of inquiry, of which General Gaudin is president, on the subject of powders believe they have found the cause of the terrible disasters in the past.

The formula of powder B, due to M. Vielle, is of itself good, only when the care of manufacture is of a very high order. The slightest impurity in any of ingredients will cause reactions strong enough to decompose and ignite the powder. The main offence in lack of care has been in the purification of the raw cotton.

Austria and Russia have never had trouble with powder B where its manufacture is conducted with the greatest care and attention to detail.

M. de Chardonnet says that the cotton and the nitric acid are the materials needing closest watch. The nitration must be absolutely homogeneous. Fibers badly nitrated decompose easily, especially in the conditions found on board ship. Vielle powder made with proper care is free from any danger of decomposition.

M. Delpech says that powders chemically pure are transparent, that M. Vielle's formula is not perfection, but produces a mixed material, porous, and very sensitive to moist air. Our sailors all know that American and Russian powders are greatly superior to their own, in uniformity of material as well as density. Our powder makers should swallow their pride and copy methods of foreigners because the latter have better success than we do.

M. Painlevé, rapporteur of the naval budget, says that French powder manufacture has been isolated from supervision, separated from everyone by a true wall of China. This industry, on the contrary, in other nations has been subjected to the closest scrutiny with no obstacles put in the way of inspectors. There are two things we can do, either,

(a) Manufacture our powder carefully, or

(b) Adopt nitroglycerine powder. Germany, which manufactures most methodically all kinds of modern powder, has adopted for its army nitrocellulose, similar to powder B, and employs for its heavy ordnance, and consequently for its navy, nitroglycerine powders.

M. Bénazet (rapporteur), of the powder budget, says that an excess of sulphuric acid has crept into the mixed acids quite frequently. The proportion of half sulphuric and half nitric is as high as is safe, but yet 660 parts by volume to 1000 parts by volume, sulphuric to nitric has been common, and, in the pyroxyline manufacture, of which he has had much experience, productive of many spontaneous ignitions.

The conclusion reached is that if purification of raw materials, and manufacture be accomplished, no more radical solution of the powder problem is necessary.

THE FRENCH MISTRUST OF THEIR POWDER.—M. Painlevé recently, on being interviewed at Brest, said:

"My conviction is stronger than ever that it is criminal to wait longer before making a radical solution of the powder problem. The powders landed by the third squadron would have to be re-embarked in case of a mobilization, but I believe that nobody would dare to give such an order. The result of such an order would be deplorable.

"In the firing of the third squadron they used only charges put up in cartridges and not a single bagged charge. This powder question then is the most urgent problem before Parliament. I strongly hope that the discussion on the naval appropriation will not end without the necessary decisions being made.

"It is necessary to control private industries, break the monopoly, and manufacture powder in government factories."

MARINE ENGINEERING.

OIL-FUEL CAPACITIES.—That of the *Nevada* class is 598,400 gallons or 2350 tons; of the new British battleships is to be 2500 tons, though this has lately been denied; of the *Gangoot*, Russian, is 1170 tons in addition to coal, and the *Courbets*, French, and *Orions*, English, carry 1000 tons in addition to coal.

OIL STORAGE.—The navy oil depots at Kiel and Wilhelmshaven are to be enlarged. This announcement indicates the growing use of oil, if not as a prime mover, at least as an auxiliary fuel for German ships. All large German war vessels laid down to date are coal burners, but most of the newest are fitted to burn oil as well as coal. Meanwhile, reverting to the Diesel oil engine, two engines with a designed horse-power of 12,000 or slightly over have been constructed to government order, one at Nuremberg and one at Kiel, and a third marine engine of greater power is in hand. As no sane government would order such costly engines without a definite objective, it is fair to assume that Germany will be first in the field with oil-driven war craft. In so far as it lies open to public study, German naval strategy has one or two gaps which would be filled admirably by such craft. This scheme of strategy deals largely in "diversions" to be made with the aim of compelling the strongest naval power to divide its forces, and the strategists in Berlin consider that this division can be brought about most surely by interfering with the enemy's food supply. Some authorities hold the battle-cruiser to be the ideal type for this operation, but they are in a minority. Others pin their faith in the oil-driven cruiser of moderate tonnage and respectable speed, whose great value will reside in her complete independence of fuel bases for months on end. When Germany adopts the Diesel principle in earnest, it is almost certain that it will be represented first of all in a commerce-destroying type of cruiser.—*Naval and Military Record.*

PERFORMANCE OF A TOSI TURBINE.—The trials of the destroyer *Indomito*, built by the "Societa Officine e Cantieri Napoletani C. & T. T. Pattison," of Naples, were recently held. This vessel is the first of the six destroyers withTosi turbines being built by the firm for the Ministry of Marine. The *Indomito* destroyer has a displacement of 680 metric tons and is 73 metres long, 7.32 wide, and 4.82 deep. She carries four tubular boilers, two Tosi turbine engines, constructed by Messrs. Franco Tosi, of Legnano, and each driving one of the two propellers. The two turbines, of 15,000 horse-power, estimated, gave during a three hours trial a speed of 35.09 knots, much greater than that specified in the contract, thus the *Indomito* is the swiftest craft in the Italian Navy. The excellent results obtained both from the point of view of working and consumption, in spite of the somewhat limited weight and dimensions of the turbines, as required in torpedo-boats, are

the more remarkable, because these turbines were invented and made in Italy and have numerous novel features.—*Marine Engineer and Naval Architect.*

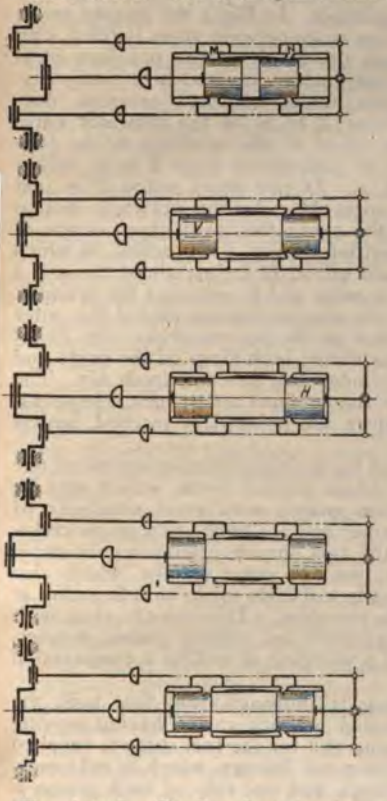
WARSHIPS SPEED TRIALS.—The circumstances that the steaming trials of the British *Princess Royal*, the German *Kaiser*, and the Italian *Dante Alighieri* are being run about the same time affords ground for several interesting comparisons, but the value of such comparisons must be entirely dependent upon the fulness and reliability of the reports of the vessels' performances. It is not enough to have the speed which each ship developed without knowing also the state of the sea and the weather, whether the vessel was fully loaded or running light, and by what method the speed was reckoned. In fact, at present we have not sufficient knowledge of the elements and conditions under which recently completed warships have been tried which might enable us to form a common standard for comparison. The *Kaiser's* reported speed of 23.6 knots is, therefore, interesting, but it would be more convincing to learn that the vessel had made such a speed under the actual service conditions. The battle-cruiser *Moltke* was credited with the fine speed of 29.47 knots on trial in September, 1911, and when she was chosen to visit New York in the spring of this year there was every anticipation that she would attempt to lower the trans-Atlantic record of the *Indomitable* on her return journey. But she did not succeed in doing so, and the speed at which the return trip was made has never been made known, though it would certainly not have been concealed had it exceeded that of the *Indomitable*. As regards the speed achieved with the *Kaiser*, however, the Germans have reason for self-congratulation, since this first turbine-driven battleship in their navy has achieved a rate exceeding that of any other battleship of which detailed results have been made known. The *Conqueror*, with 23.25 knots, would seem to have made the nearest approach to it. The *Dante Alighieri*, claimed by the Italians to be "the fastest *Dreadnought* battleship in the world," is designed for 23 knots, but her trial speed is not yet known. Meantime, the steaming performances of the battle-cruisers *Lion* and *Princess Royal* remain unequalled by any navy in the world.—Editorial in *Army and Navy Gazette*.

THE JUNKERS OIL ENGINE.—Prof. H. Junkers, of Aachen, Germany, has developed a remarkable internal combustion engine utilizing the combustion (not explosion) of cheap, low-grade liquid fuels by the compression-ignition method of the Diesel engine, but with certain radical improvements in design which give increased efficiency and adaptation to all power purposes.

Just as Watt is the father of the steam engine in its manifold forms, so in our own day Dr. Diesel is recognized as the first worker in the field of the internal combustion engine burning cheap fuel. Now comes the Junkers engine as a radical improvement in this field. Existing engines utilizing cheap fuel oils to generate power at economies unattainable in the best compound steam engines, have left much to be desired for certain stationary and marine applications, and have been inapplicable to locomotive propulsion. The need has been for an engine which could generate cheap power from low-grade oils—down to even the asphaltum oils and their residues—not only for all stationary purposes, but for propelling vessels under practical conditions and for driving locomotives.

This need is now filled in the Junkers oil engine, in which the combustion of the fuel charge in a single cylinder urges two pistons in opposite directions. The cylinder is a simple tube, open to the atmosphere at both ends—no cylinder heads, no stuffing-boxes, no valves with mechanism. The greatly superior heat efficiency, high aggregate piston speeds with low speed of each separate piston, better scavenging and cooling and lower cooling losses, and the absence of valves enable this engine to show a marked reduction of weight per horse-power—down to less than one-half, in some

cases one-quarter—and a decided increase in efficiency when underloaded and in overload capacity. The design allows higher speeds and also a greater range of control of speed. Actual engines in use include the propelling equipment for twelve ocean-going vessels now under construction, stationary engines being manufactured by prominent European companies. At present a locomotive of 2000 horse-power, designed for a speed of 125 kilometers per hour, and weighing less than a steam locomotive, is under construction. The field open to this type of prime mover is indicated by the fact that it consumes any cheap liquid fuel, even including asphaltum crude oils.



Figs. 1 to 5.—(Reading from top to bottom) diagrams showing operation of single-cylinder Junkers engine.

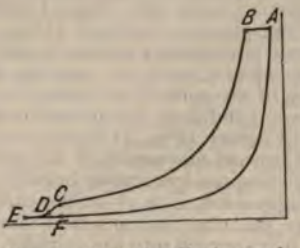


Fig. 6.—Typical indicator card.

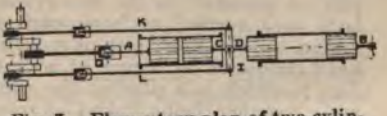


Fig. 7.—Elementary plan of two-cylinder horizontal tandem engine showing connecting-rod system for the two inner pistons operating on the side cranks.

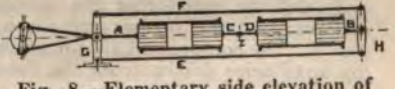


Fig. 8.—Elementary side elevation of two-cylinder engine showing connecting-rod system for the two outer pistons operating on the center crank.

Without dwelling on technical details, the fundamental principle of operation of the Junkers oil engine may be understood by an inspection of the annexed schematic diagrams (Figs. 1 to 5) of a single cylinder engine—cylinder and pair of pistons, and the connecting rods and cranks of the engine in five successive positions throughout one revolution—in conjunction with the indicator card (Fig. 6).

The arrangement of parts in the five diagrams is clear on first inspection in all but one feature. The obvious features are the open cylinder without cylinder heads, the two pistons moving alternately outward, that is away

from each other, and inward or toward each other, the left-hand piston *V*, being connected directly to the middle one of three cranks and the right-hand piston *H*, being connected to a cross head and a pair of parallel connecting rods to the two outer of these cranks 180 degrees from the middle crank; and the movement of the pistons, successively outward and inward, thus turning the main shaft. The object of the ports *M* and *N* will be understood as the operation of the engine is traced through one complete revolution.

The engine works on the two-cycle principle. In Fig. 1 the pistons are at the inner dead center, and the combustion space between them is filled with highly compressed, highly heated air as the result of the previous compression stroke. In this position the oil fuel is injected in a finely dispersed condition, igniting and burning under constant pressure during the first part of the outstroke (from *A* to *B* on the indicator card, Fig. 6). With the supply of fuel cut off at *B*, the working stroke continues with expansion of the products of combustion from *B* to *C*, bringing the pistons to the position of Fig. 2. At this point piston *V* is just about to open the ring of exhaust ports *M*. As the outward motion of the pistons continues (*C* to *D* on the card) the spent gases escape at about atmospheric pressure, and the position of Fig. 3 is reached, in which the exhaust ports are opening wider and piston *H* is just about to open a ring of air-ports *N*, allowing fresh air to enter and to scavenge the cylinder. These conditions are maintained until the pistons, having passed the outer dead center (Fig. 4) begin to come back on the return stroke. In Fig. 5 the inward movement of the pistons has closed both rings of the ports and the compression stroke begins on a cylinder full of cool, fresh air. The compression, *F* to *A* on the card, heats the confined air to such a temperature that the fuel, injected shortly before the point *A* is reached, ignites as it is sprayed into the cylinder.

The above is the complete cycle traced for a single cylinder engine of one pair of pistons. In the two-cylinder (four-piston) form, which may be built as a vertical or horizontal tandem engine with great simplicity of design, the two inner pistons move together and are linked to a single crosshead connected by a pair of rods to the two outside cranks, as shown in Fig. 7, which is a plan of the engine; the two outer pistons, which also move together, being linked by crossheads and rods to the middle crank at 180 degrees, as shown in Fig. 8, a side elevation. This construction, with two pair of connecting rods, in the horizontal and vertical planes, respectively, makes every stroke of the engine a working as well as a compression stroke.

It will be noted that the scavenging is thorough, and that both the exhaust and the former are accomplished without valves having moving parts. The compressed air for scavenging and for the fuel spray is supplied by auxiliaries driven from the connecting-rod linkage, which is extremely simple. The cylinders are simple castings, and one side of each piston is always exposed to the atmosphere and comes to rest at every outward stroke in a well-cooled region of the cylinder not touched by the products of combustion. This secures perfect cooling and lubrication. Finally, owing to the division of the total stroke between two pistons in each cylinder, a high-piston speed is attained with low individual piston speeds, and a long cylinder of small diameter, most favorably adapted to thorough scavenging and to perfect combustion, may be used.—Joseph B. Baker, *Scientific American.*

THE TURBINE AND BATTLESHIPS.—With the extensive adoption of turbine propulsion which has been so marked a feature of marine engineering during the last decade, and with the eyes of progressive engineers all over the world now turned to the experiments on a large scale which are being made with the later developments of the oil engine for marine purposes,

it is perhaps excusable if one should have come to think that the battle between the older system of steam reciprocating engines, and the newer one of steam turbines had been fought to a finish, but this is apparently by no means the case. In a trenchant paper delivered by Captain C. W. Dyson to the Engineers' Club of Philadelphia in January last, the author appears in his usual effective style, and reveals himself to be somewhat of a special pleader for the steam reciprocator as still the best system of propulsion for large units such as battleships and fast liners. Whilst ceding to the turbine pride of place for such vessels as torpedo-boats, destroyers, and scouts, where speed and power are high, and the hull structure light, he makes out an exceedingly strong case for the steam reciprocator on battleships where the engine foundation is substantial, and the speed more moderate. Early experiments in America with the marine turbine were a little unfortunate, Curtis turbines were fitted in the Southern Pacific steamer *Creole* and in the yacht *Revolution*. In each case the result was unsatisfactory, and the engines were removed from these vessels. The *Creole* had water-tube boilers, which caused an element of doubt in some minds, but when reciprocating engines took the place of the Curtis turbines the ship attained a high efficiency, demonstrating the fact that neither hull efficiency nor boilers were contributory causes to the want of success. Soon after this the United States Navy carried out very exhaustive trials with three scouts specially fitted to throw light on the relative merits of the systems of propulsion then under discussion. The *Birmingham* had steam reciprocating engines, the *Salem* Curtis turbines, and the *Chester* Parsons' turbines. In this contest the Parsons' turbine was considered to have scored an easy win. On the whole, although the *Creole* was not a success, the turbines were reported upon by navy experts as adapted for marine propulsion. It should be stated that at this period most stress was laid upon efficiency at maximum power, and it was only at a later date that the relatively poor results given by turbines at low cruising speeds became insistent.

In 1907 the United States Navy decided to build two battleships to be called *Delaware* and *North Dakota*, the former to have reciprocating engines of the most advanced type, and the latter Curtis turbines. Exigencies of design did not allow of Parsons' turbines being adopted, engine-room space limitations preventing. Every endeavor was used to make the reciprocating engines as perfect as possible, auxiliaries and main engines alike being designed with the greatest care. As compared with the older types of reciprocating engine, the following changes were made on the Delaware: (1) Increased ratio of low-pressure to high-pressure cylinder capacity were adopted; (2) steam valves were modified to give short straight steam and exhaust ports; (3) steam was subjected to 60 degrees of superheat; (4) bearing pressure on crank pins and crossheads was reduced; (5) forced lubrication was fitted to the crank-shaft, crank-pins, crosshead journals, and slides and excentrics. All this greatly improved the efficiency of the engines, with the result that a comparison of the trial data with those of older types showed that with an air pressure of two inches, which is the limit with coal-burning Babcock & Wilcox boilers, the improved engine gave 25.6 indicated horse-power per square foot of grate, as against 20.6 indicated horse-power per square foot of grate with the older type, an increase of economy of 24.3 per cent. The author attributes 6 per cent of this to superheat, and the remaining 18.3 per cent to increased mechanical efficiency. He gives a comparison of the water consumption of this vessel with that of the scout *Birmingham*, not quite a fair thing to do, perhaps, but these were the only two ships upon which water consumption measurements on trial had been made, of which the data were available. The result he gives as follows in pounds of water per indicated horse-power: *Delaware*, at full power, 13.38 pounds; at five-eighths power, 12.7 pounds; at one-eighth power, 15.12 pounds; *Birmingham*, at full power, 17.3 pounds; at five-eighths power, 15.5 pounds; and at one-eighth power, 19.0 pounds.

The superiority of the *Delaware* is very great, but we think it will be conceded that the water consumption is exceptionally good for reciprocating engines, and one is inclined to doubt the probability of attaining that degree of efficiency in all cases. As confirmation of this result, however, the author quotes trial data of a collier, the *Cyclops*, whose engines, of about 7300 indicated horse-power, were built on battleship lines. In this case the water per indicated horse-power worked out at less than 12 pounds, neglecting leakage and cylinder condensation. It is upon such a basis that the comparison with the turbine-engined *North Dakota* is made, and not upon the more usual results obtained, as in the *Birmingham*. This is, perhaps, quite in order, since Captain Dyson has been so successful in obtaining such a marked advance in the reciprocating engine. At the same time it should be remarked that the *North Dakota* did not represent the full possibilities of the turbine engine, nor even of the Curtis turbine, for it was of an early type, and necessarily still going through the infantile troubles which are incident to all new departures. There are building at present turbines which will give as good or perhaps better results than those of the *Delaware* even at low speeds.

The case for the turbine is categorically stated in the paper, and most of the claims which are made for it negatived. These are: (1) Turbine engines are capable of being driven for long periods at high power without derangement, and less work is required to keep them in condition than reciprocators. The author claims that the *Delaware* has proved herself capable of the same lengthened service, and that, moreover, when anything does go wrong with a turbine engine it is a case of hospital treatment, the trouble being often blade stripping, especially of cruising turbines when running in vacuum. He maintains that the engine-room staffs differ very little in the two cases.

(2) There is less vibration with the turbine, and therefore more accurate gun-laying. Captain Dyson contends that with well-balanced reciprocating engines, on such a foundation as a battleship provides, the older engine offers no disabilities in this respect, and quotes the cogent fact that the *Delaware* has won the battle trophy for gun-laying, beating the *North Dakota* easily.

(3) Less boiler equipment is required to develop the power necessary for full speed with turbines—against which is marshalled the splendid water consumption of the *Delaware*, and the fact that the propeller diameter made necessary by the high revolutions of the turbine involves a lower propulsive efficiency, and so counteracts any advantage the turbine may have in this respect. Results are given of trials with the three battleships *Delaware*, *North Dakota*, and *Utah*, the latter having Parsons' turbines. Taking propulsive efficiency to be represented by effective horse-power with excrescences ÷ indicated horse-power for the *Delaware*, and effective horse-power with excrescences × .92 ÷ shaft horse-power for the turbine ships, 8 per cent being allowed for engine friction, he gives:

	Delaware, Reciprocating.	North Dakota, Curtis turbines.	Utah, Parsons turbines.
Speed, knots.....	21	21	21
Revolutions.....	122.5	265	313
Propulsive coefficients...	65	53.82	56.12
Speed, knots.....	12	12	12
Revolutions.....	66.5	140.75	192
Propulsive coefficients...	69.3	61.32	53.18

Furthermore, he states that the *Delaware* showed herself to be 20 per cent better in bad weather, and 44 per cent better in good weather than the *North Dakota* when on a cruise with the fleet from America to England and back. These discrepancies are enormous, but are qualified by the fact that

the turbines were found to be damaged by erosion and corrosion when subsequently opened up.

The author flatly denies the claim that the turbine demands less floor space. He grants greater economy of lubricating oil, but not of fuel oil. He also grants greater cleanliness in the engine room, but only at high speeds, and he agrees that the turbine has a greater capacity for overload without allowing any special virtue in the quality. No advantage is claimed for turbines on the score of weight; the *Delaware's* engine-room weights were 773 tons, and those of the *North Dakota* 783 tons—a negligible difference.

On the whole, then, the turbine as applied to battleships and to fast liners has to face a very strong indictment, and it cannot be denied that the case rests mainly upon the splendid performances accomplished by Captain Dyson with the *Delaware*. No mention is made by the author of one valuable feature exhibited by the rotary engine as against the reciprocator, that is, the increased length of life which may be expected from the shafting of turbine engines, they not being subjected to the continuous alternations of stress which are present with even a well-balanced reciprocating engine, nor to the ease with which the turbine engine may be protected from gun fire, owing to its low position in the ship well below the water-line.

The position taken up by the navy authorities of the United States with regard to the engines of the lighter units is clearly indicated by the simple announcement that the last eight vessels of this class ordered are all to be turbine driven, and all to be twin screwed. For these vessels there is no question of the superiority of the turbine, and it seems to be agreed that the twin-screw arrangement offers more advantages than the triple. Captain Dyson makes no reference to recent developments with geared turbines, but the late Rear-Admiral Melville in the discussion warmly advocated this feature, and claimed that the future of the turbine depended upon the attainment of better propeller efficiencies, by means of reduced revolutions, either by gearing or by electrical transmission. Whether direct-driven turbines of combined impulse reaction type will eventually make this complication unnecessary or not it is difficult to say, but it is certain that simplicity, if not too expensive, is always a quality to be aimed at, and direct driving is simpler than gearing.

The paper is of the greatest interest, and puts the whole question of battleship propulsion in a new light. The author with his clear-cut analysis and telling facts is difficult to refute, but we believe the answer to him is just that he has compared the very latest and most ingenious reciprocating engine practice with one form of turbine mainly, and that in its early stages of development, which is obviously unfair. The comparison should rather be made between the best that is likely to be accomplished with reciprocators in the future, remembering that all possible improvement seems to have been made, and the promise that is held out by the best types of turbine in combination with suitable propellers, and here who shall limit what the future holds, in view of what has already been and is being accomplished. Much of the ground is quite new, specially that upon which rests the problem of the best way to adjust the differences between the requirements of the propeller and the turbine for good efficiency.—Editorial in *The Engineer*.

RADIO.

THE RADIO STATION AT ARLINGTON.—This station is now completed and in working order. A lieutenant in the navy and twelve enlisted men comprise its crew. At a designated hour daily messages covering official business with the fleet are radiated to American warships. Daily hydrographic reports, notices to mariners acquainting them with the existence of derelicts and icebergs or other information, are sent to merchant vessels in the steamer lanes.

Only one other similar structure in the world is as high from the ground as the central tower at Arlington, and that is the great wireless steel tower

at Nauen, near Potsdam, Germany, which was completed last February and is able to communicate with America. Unlike the Arlington arrangement, the Nauen station has a single steel tower, 650 feet in height, around which spread like umbrella ribs a series of thirteen wooden masts, each 128 feet high, from the peaks of which antennæ stretch 650 feet long.

The Arlington station will not be able to receive messages from the distance to which it can send them; at least not from every plant with which it may communicate. The plant at Arlington is powerful enough to receive any message that may reach it. But in the beginning of its existence few, if any, of the great stations will be able to send messages regularly a like distance under ordinary conditions, and few craft, even under the most favorable weather, are able to send a message over a thousand miles. A vessel with a ten-kilowat naval radio plant may send a message 800 miles, under ordinary circumstances, and 2000 or more miles when the atmosphere is freakish. With a sending radius of 3000 miles in ordinary weather, the Arlington station is expected to have a sending radius of 4000 or 5000 miles in freak weather, and it is thought that some time during its history the Arlington station may experience a peculiar condition of weather which might enable it to send even as far as Japan.

To avoid smoke, dust and vibration the power for the operation of the plant is derived from the electric conduits of the city of Washington. This power drives a 200 horse-power electric motor, which in turn drives what is described as a 100-kilowat 500-cycle alternating generating plant. Two currents, one of which is primary and of 100 volts, the other secondary and of 12,500 volts, are produced by this generator. The primary current passes into a novel transformer, which "steps up," and is increased into a high current of 12,500 volts in the secondary circuit.

The two wings of the station are separated by short vestibules from the central machinery plant. These vestibules are wooden. The connections of the vestibules with the brick work are padded with linofelt, which takes up the vibration from the machinery plant and avoids corresponding complications in the operating rooms. There are two of these rooms. One is occupied by the radio operators, the other by those who man the telephone and telegraph wires connecting the station with the outside world. The radio operators' room is unique. It is built somewhat upon the style of a huge refrigerator. It is absolutely sound-proof, and when its door is closed the radio operator on duty cannot be bothered by any sound from without or vibrations. The only entrance into the radio operating room is through a double refrigerator door. The room has no windows, is artificially lighted and ventilated. Even the air used in doing this is sound-proof, as it passes through a series of air ducts in which "baffle plates" are strung so as to baffle any noise that may attempt to creep with the ventilation into the radio operating room.

A separate room has been set apart for use by operators of the land wires. Connecting it with the sound-proof radio operating room is a telautograph. When a message is to be sent by wireless it is not taken through the refrigerator door into the radio operating room, but is laid down there by the outside operator through use of the telautograph. The outside operating room does not have to be storm and vibration proof and is connected with the outside world in three ways: by public telegraph, and private and public telephone. There is a private telephone wire leading direct from this outside operating room into the Bureau of Navigation in the Navy Department. This avoids any leak of official messages through use of the city telephone service. Should anything happen to this official wire the plant has another telephone connection through the regular city switchboard. Within reach of this outside operator are keys connected with the telegraph systems of the Postal and Western Union companies, by means of which any wireless message may be relayed over land wires to any part of the United States.—*Army and Navy Journal.*

THE RESTRICTION OF WAVE-LENGTHS BY THE LONDON RADIO-TELEGRAPHIC CONVENTION.—The specific prohibition of the use for public service of wave-lengths between 600 and 1600 meters, the stipulation that all ship communication shall be on either 300 or 600 meters wave-length (with the possible use of 1800 meters for long-distance transmission) and the cumbersome form of sending messages would seem likely not only to work an extreme hardship upon corporations engaged in commercial radio-transmission, but also to bring about a considerable decrease in service efficiency.

The fundamental wave-lengths of ship antennas average about 400 meters, with extreme points about 150 meters above and below. Modern transmitters operate efficiently at wave-lengths from about one and one-fifth to say four times the natural wave-length of the antenna used and give best results at about two and a half times this. Therefore, the working ranges of wave-lengths for small, average and large ships are 300-1000, 480-1600 and 660-2200 meters respectively. Since it is considered impossible to transmit with good efficiency at wave-lengths below the antenna fundamental, it is very evident that in prohibiting the range between 600 and 1600 meters the government has effectually prevented ship-to-ship and ship-to-shore signaling under the best conditions. This is without regard to the effect of atmospheric absorption, which causes remarkably rapid attenuation when wave-lengths less than 800 meters are used and so increases the difficulties of transmission with short waves.—From an Editorial in *Electrical World*.

The regulations adopted by this convention may be found in full in *Electrical World* of September 28, 1912, page 648.

THE BETHENOD WIRELESS SYSTEM.—The distinguished French scientist, M. Bethenod, states that the descriptions already given of his newly discovered system of wireless telegraphy have not been at all accurate. His invention, he states, is not an improvement on the apparatus system of communication, but the discovery of an entirely new principle of wireless. All scientists had for a long time been searching for a sparkless wireless. Some had succeeded, notably the American inventor Alexander Anderson, but the machines thus made are high frequency alternators, with which the Bethenod system has nothing to do. Machines like Anderson's, said M. Bethenod, are really toys, for they are extremely expensive, and are able to emit only 6000 meter waves. Bethenod's machines are solid and practical and can give 60,000 meter waves. To give the others the same power, if it were possible, would cost millions of dollars.

M. Bethenod's apparatus is in two parts, the machine proper and the antennæ, both being special. The spark is suppressed and the oscillation is produced by special machinery. A very important point, and this was the important object aimed at by the discoverer, is the production of long waves. The difficulty with the present wireless is the short wave, with whose progress all other short waves in the atmosphere interfere. Long waves are not troubled or interfered with by the short ones. The longer a wave is the less it deteriorates. The long waves emitted by Bethenod's apparatus are completely independent of the phenomena of nature. Moreover, the short waves cannot mathematically be measured accurately. One can possibly be measured, but the next one cannot, owing to the depression. On the contrary Bethenod's waves are all measured mathematically and very accurately. Before launching a wave he knows its mathematic measure, for he is a very distinguished and scientific mathematician. The production of long waves and their measurement is the great problem whence, as all scientists know, will float the greater application of wireless to telegraphy and telephony and rapidity of transmission.

M. Bethenod has made numbers of practical experimental applications, notably between Paris and Brussels. He used the existing supports or masts, and then after carefully testing the antennæ sent an experimental 2000 meter wave. He next used an apparatus which allowed a 20,000 meter

wave. He measured the waves and found the communication by the long wave better than by the shorter one. In this connection a very important result was found, that the long wave was obtained with the same antenna and supports—that is to say, at exactly the same expense as the short one. He was so well satisfied with the results obtained that he has ordered machinery of high power, and hopes in a few months to be able to communicate from Paris to America. He states that his wireless messages will not be intercepted, that other stations will not interfere on account of the great length of the meter waves, but if a post wishes to intercept a message that can easily be effected, and that secrecy of transmission is a separate problem.

Such are the claims of the inventor, which, it is to be hoped, can be fully substantiated, for wireless, though still in its infancy, has already demonstrated its great value, and its achievements thus far justify its inclusion among the wonders of the world.—*Army and Navy Journal.*

AERONAUTICS.

The German naval dirigible of the Zeppelin type carries a crew of two ordinary naval officers, one engineer officer, one special pilot, and ten men. Hamburg has been selected as the headquarters for naval dirigibles. The aeroplane headquarters are at present at Danzig.—*The Engineer.*

THE GERMAN NAVAL AIRSHIP *L. 1.*—On the 17th of October the first Zeppelin airship of the German Navy was taken over by the government. The *L. 1*, which has been constructed at Friedrichshafen under the supervision of Count Zeppelin, is about 525 feet long, 50 feet in diameter, and has a cubic capacity of 706,300 cubic feet; it has three Maybach motors, one in the front gondola and two in the back one, each with a capacity of 170 horse-power; the balloon consists of eighteen gas cells. The forward propellers, which are of aluminium, have two blades and the rear propellers four blades. The horizontal steering gear has six vertical surfaces and the elevation steering gear eight horizontal surfaces. An observation platform of sheet aluminium is erected on the top of the balloon, which is reached by means of a shaft. In the gangway between the two gondolas is a room for officers and men, in which wireless telegraphy apparatus is fitted up. Arrangements have been made for bomb-throwing in time of war. After a few trial trips of small extent made at the beginning of the month, the airship set out from Friedrichshafen on the 13th with twenty-one persons on board, among whom were the Government Examining Committee and Count Zeppelin, and after remaining in the air for thirty-one hours, landed at Johannisthal. The journey proceeded by way of Bielefeld to Norddeich, on the North Sea, and then eastwards via Helgoland, Kiel, Lübeck and Hamburg to Berlin, a total distance of about 1050 miles, the average speed being 33 or 34 miles an hour. The *L. 1* is stated to have successfully fulfilled all the requirements of the naval authorities.—*The Engineer.*

HYDROPLANE STATION FOR THE FORTH.—A new department is to be established by the English Admiralty on the north shore of the Firth of Forth immediately to the east of the Forth Bridge and in close proximity to the heavy battery at Carlingnose. This new department is to be a base for hydroplanes, which will in all likelihood work in conjunction with the fleet in the way of effecting scouting operations. After much search up and down the coast the government authorities have decided that the spot selected is the finest in every way. It is ideal for hydroplane testing in respect that there is a long stretch of flat foreshore composed of yellow sand, and there is ample room to operate such machines without interrupting or being interrupted by shipping. Moreover, the place, which was a favorite picnic resort for Dunfermline and other holidaymakers and which is to be vacated by the present tenant within six months, obviously lends itself to

the centralization of government departments, for besides being overlooked by the fort at Carlingnose, which is to become the artillery headquarters for Scotland instead of the Leith Fort, it is not more than two miles from Rosyth and little more than four from Crombie.—*Page's Weekly.*

London cables of September 12 state that on account of the recent casualties to aviators of the British Army Flying Corps, four lieutenants having been killed within a week, the War Office has suspended the use of monoplanes in the service. British Army aviators consider that biplanes are safer and more stable than monoplanes. Machines of the latter type have been used, however, because they are speedier.—*Army and Navy Journal.*

MISCELLANEOUS.

NAVAL STRATEGY IN THE BALKAN WAR.—The navies of the Balkan powers may possibly not play an unimportant part in the war now in progress. The Turks have about 110,000 soldiers actually mobilized in Asia Minor between Smyrna and Scutari, and of course this force is constantly augmented by the reserves. It is easy to see then that Turkey must be able to transport these soldiers from Asia Minor to Europe. The shortest distance is that between Scutari and Constantinople, crossing the Bosphorus or the Dardanelles at Gallipoli. The defence of these points has been weakened owing to the withdrawal therefrom of many heavy guns for the defence of Adrianople. The Turks must therefore be able to transport by sea directly from Smyrna to Salonica, which is directly connected by rail to all important parts of Turkey, the major portion of its Asiatic soldiery. Being masters of the Aegean Sea they can do this. Peace with Italy has left their fleet free to take the sea. Thus we see that command of the Aegean is a military necessity for the Turks, and likewise it becomes so for the Greeks, because reinforcement of the Turkish Army must be prevented at all costs.

The truth of the adage "all depends on the command of the sea," is likely to again be demonstrated, particularly as the Balkans are now so far in the lead ashore that the Turks must be defeated unless they can get troops from Asia Minor.

The Turkish fleet ought now to find the principal Greek force and destroy it.

Similarly the Greek Admiral Kondourioti ought to keep his fleet close to the shores of Asia Minor to prevent all movement of the Turkish convoys with his destroyers placed as scouts, and to sink unconvoyed transports. By making use of the various islands in the Aegean Sea, the Greek fleet should be able to do much damage to the Turkish convoys without exposing themselves greatly. This is an ideal place for operations of the large Greek submarine *Delphin* to do much damage at little risk, save the navigational ones, to the convoys.—*Le Yacht.*

Of the facilities for safe anchorage and hasty repairs, which are so important to small navies, the following summary may be taken as covering the whole of the available resources. Otia Bay, which in 1904 was subjected to some examination by British naval experts, is said to form a good destroyer base, being capable of egress and approach in the dark. The Greeks will probably use this. The Island of Zanti has a coaling station, with a mole in the harbor, which enables war craft to quickly replenish their stock of fuel alongside it. The Gulfs of Patras and Corinth are marked as affording good and sheltered anchorage and a base for supplies, whilst the Corinth Canal, connecting the Gulf of Corinth with the Bay of Athens, is now an important feature of the scene of operations. It is passable by small cruisers. The Greeks have several dockyards, namely, one at Poros Island, south of Athens Bay, another at Salamis; they also have a large floating dock some 100 yards by 20 yards, so it will be seen that there is ample scope for an intrepid and determined Greek commander to carry on

buccaneering operations in the west. Further east, the Turkish authorities hold a stronger position, the Dardanelles and the Bosphorus being practically unassailable by reason of the dominating guns of the Dardanelles. These give Turkey the command of the Black Sea and the Sea of Marmora, from which they can land their forces at will.—*United Service Gazette.*

Turkish gunboats on Lake Scutari have done something to hinder the Montenegrin advance by bombarding their lines, but work of that sort cannot have any measurable effect on the run of the campaign. Should the war spread, the Black Sea might conceivably witness an advantageous exercise of Turkish sea power by threatening Bulgaria or Roumania at various points, and thus preventing the whole of the military forces of those nations being massed for fighting on the land frontiers. The influence of the naval factor would naturally be considerably greater if Greece should join the fray; but, on the whole, there is a decided tendency in this country to exaggerate the naval possibilities of the war. History shows that in conflicts between nations with coincident frontiers sea power always plays a decidedly minor part, and it is certainly improbable that the rule will be broken by the Balkan States.—*Naval and Military Record.*

Some brief notes have been given in the preceding pages of the Turkish and Grecian Navies in view of the present probable interest in them. They are the "principal" naval powers engaged; of the others Servia, has no sea frontiers, nor does she appear to possess any craft for the patrol of the Danube. Montenegro—the monarchy with a population of an average London suburb, which has put the match to the powder barrel—is the possibly proud possessor of a single vessel, a Royal yacht named *Zmdy*, launched in 1899, displacing 140 tons, and armed with two 3-pounders. Bulgaria and Roumania both possess a number of war vessels of the smaller types, but the only seagoing vessels owned by either is the Roumanian cruiser *Elizabetha*, launched at Elswick a quarter of a century ago. She displaces 1325 tons, and is armed with four 6-inch and a number of smaller guns. This state also possesses a number of river craft, including four efficient monitors of 581 tons displacement built in Austria in 1907. The names are *Joan Bratiano, Lascar Catargi, Lahovary,* and *Michael Cogalniceanu*, and they are armed each with three 4.7-inch guns in an equal number of turrets, and with two howitzers of the same caliber, while their speed is 14 knots. There are also three older and smaller gunboats, a despatch vessel of 130 tons, launched fifty years ago, and a couple of yachts.

Bulgaria has devoted more attention to torpedo craft. Three 98-ton torpedo-boats, the *Chrabri, Smeli,* and *Bistri*, were launched at Varna in 1907, their armament consisting of three 3-pounders and three torpedo-tubes, and their speed being 26 knots. There are also three smaller but newer torpedo-boats, a 715-ton torpedo-gunboat, the *Nadjezda*, launched at Bordeaux in 1898 and armed with two 4-inch and five smaller guns; and also two armored gunboats for service on the Danube. It will be seen that neither of these states would be able to do much at sea, and the vessels on the Danube have no opportunity of damaging Turkish property.

THE ENGLISH FLEET MANEUVERS OF 1912.

THE ENGLISH FLEET MANEUVERS OF 1912.—The Red fleet consisted of the battleships *Neptune*, flying the flag of Admiral Sir G. Callaghan, commander-in-chief of the home fleets; the *Collingwood*, flying the flag of Vice-Admiral Sir S. Colville; *St. Vincent*, flying the flag of Rear-Admiral C. E. Madden; *Bellerophon, Dreadnought, Temeraire, Superb*, and *Vanguard*, of the first battle squadron; the *Gloucester* and *Liverpool*, attached cruisers; the cruiser *Leviathan*, flying the flag of Rear-Admiral E. Bradford, and the *Cumberland, Cornwall, Donegal, Berwick*, and *Essex*, of the training squadron, and the *Hampshire* and *Suffolk*, of the Mediterranean cruiser squadron, the seventh (Devonport) destroyer flotilla and the eighth (Portsmouth) submarine flotilla, with their attendant vessels.

Admiral Sir W. May, umpire-in-chief during the maneuvers, hoisted his flag on the cruiser *Euryalus* at Devonport. Captain W. Fisher, assistant umpire, also embarked in the *Euryalus.—Army and Navy Gazette.*

The Red fleet, which had for its objectives that of attempting an invasion on Blue territory and of waging a war on its commerce, sailed from Nore, Dover, and Harwich at 4 a. m. on July 13 and timed itself so as to be able to land troops at ten that evening at Scarborough. The cruisers steamed at head of column, the destroyers having been detached along the coast to attack the Blue destroyers, and all was going well when about nine that evening the fleet ran into a thick fog bank, so thick that a ship was invisible from her next in column. Speed was reduced, and the Red fleet stopped. The *Victorious* and the *Majestic* collided and the former was compelled to retire from the maneuvers.

In the meantime the Blue * fleet, twice the strength of the Red and under the command of Prince Louis of Battenburg on the *Thunderer*, was coaling at the Firth of Forth, the second squadron going to sea on Saturday the 13th at eight in the evening, and the third squadron sailed a little later. The flotillas of the opponents had several engagements on Saturday night and Sunday.

Blue was uncertain whether the enemy would make a dash for the Atlantic, and from his bases at South Queensferry, Cromarty, Lamlash, and Oban, had to "feel" for the opposing fleet. The vessels on the East coast were accordingly sent cruising south, while the west coast division patrolled the Atlantic side, interrogating merchant vessels as they passed for information. Red, however, at first concentrated his force in the North Sea, and remained undiscovered from the start of operations on Saturday (13th) until Sunday (14th). The attacking fleet then lay off Filey, the battle squadron in compact lines with cruisers, scouts, and torpedo craft scouring the seas to ascertain if the Blue defenders were on the scent. The unexpected happened in the shape of a fog, and, feeling the coast to be dangerous and a surprise attack possible, the landing plans were postponed for a time and the Reds steered northwards, the cruisers spread out as a screen to the remainder of the fleet.

On Monday the Red fleet had reached the North Sea near the Orkneys, having succeeded in evading the scouts of the Blue fleet which had turned south and reached Kinnaird Head, where the remainder of the battle fleet was assembled. The cruisers of the Blue fleet found the approaching enemy, and Red, closing in his cruisers in battle formation, accepted the challenge to engage. The afternoon saw the cruiser action in full progress, and in the result Red claimed the advantage, three cruisers managing to dash through unscathed and reach the Atlantic trade routes. Fog again closed the encounter, and under its cover Red again escaped, not to be sighted again until Thursday.

In this action the Red had its cruisers *Cornwall, Donegal, Cumberland,* and *Berwick* put out of action, and later on the *Achilles* and *Cochrane* were captured.

On Tuesday the 16th the Red fleet found itself free from contact with the Blue, its battleships intact and in the North Sea. As an attack on the Atlantic side appeared to have no chance, the Red fleet stopped and held a counsel. At six Wednesday evening, they got underway, the flotillas in the van, the cruisers next and lastly the battleships; an invasion on the east coast was to be attempted.

The Blue fleet kept the sea, not detaching a cruiser to keep in touch with the Red fleet then steering northward. She was trying to come in contact with the enemy, was sending some of its ships to revictual, *i. e.*, those that had not been able to fill with coal at Firth of Forth. She stopped at sea to rest the engineer force, and later held some maneuvers. The nights of Tuesday and Wednesday brought no incident.

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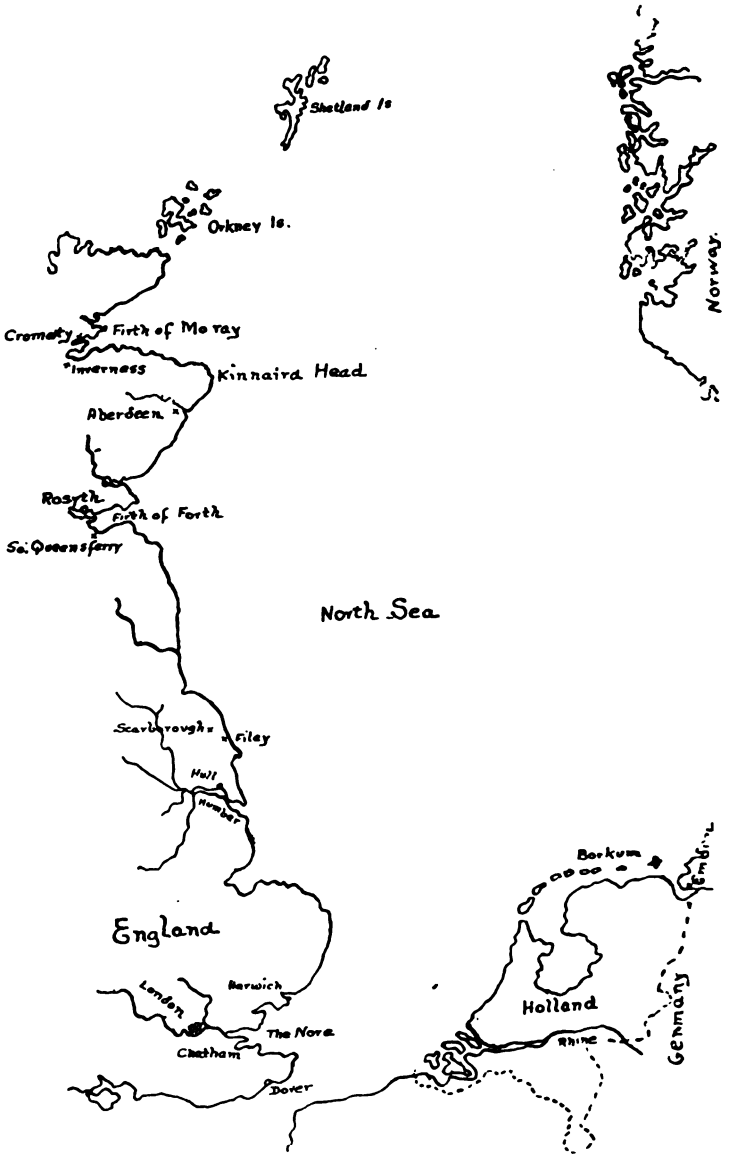
* See page 1135 of PROCEEDINGS No. 143.



ENGLISH MANEUVERS, 1912.

Scale: Rosyth to Dover by sea = 390 miles.

Lamlash and Oban are on S. W. coast of Scotland about latitude of Firth of Forth.

But on the morning of Thursday some very interesting news reached the Blue fleet, which then sailed south at full speed, the *Lion* and *Indefatigable* well in the lead, in pursuit of the Red then heading to the north to make a landing.

The Red fleet profiting by the night, and having steamed at full speed, daybreak on Thursday found its flotillas at Yorkshire without having met any opposition. The cruisers were sent to the north to watch the Blue and the battleships reached Filey where they simulated the landing of a force beginning at 6.30. After landing its troops the Red fleet was to escape by the northwest of England so as to damage commerce. It is reported by some that three, by others that four, battle-cruisers did succeed in this. The landing was accomplished in six hours at a rate of 7000 men per hour from the 14 transports. The operation was successful, there being no news of the Blue fleet until 10. At 11 the Red cruisers signalled the Blue fleet was arriving, the *Lion* being in the lead by a large amount, the invasion was discovered and the weak Red fleet had to leave.

So seeing that the landing could not be proceeded with without interruption, and recognizing that the approaching force was superior, Admiral Callaghan resolved to retire. The Blues went in hot pursuit, headed by the speedy *Lion* and *Indefatigable*, but the Red commander tried a desperate move—and it succeeded. While his main fleet was scurrying off at top speed the old seventh battle squadron—comparatively slow and heavy *Majestics*—were detached from the line and formed up in line of battle to hold the pursuing squadrons in check. The screening squadron was sacrificed, for at the end of the sharp and fierce conflict every vessel was ruled out of action, but the main Red fleet was saved, and when Blue resumed the pursuit, after having cleared away the obstruction, Admiral Callaghan was quite out of reach and beyond danger. Blue's total losses were two armored cruisers and a couple of dozen smaller craft as the result of the engagement; but Red, despite the loss of six battleships and two armored cruisers, besides several torpedo craft and submarines, was still at large and in touch with his base when, two hours after the battle, the order came from the Admiralty that the operations were at an end.

Thus the Red was the victor. It succeeded in the landing, it had been able to send three cruisers to the north to injure the Blue's commerce. One might say it had fulfilled its double mission. But the Red was obliged to take refuge in its own ports after having lost four battle-cruisers, six battleships, 28,000 men and 14 transports; while the conquered Blue had remained immune and was master of the situation.

It is a new demonstration that certain operations, invasion, commercial war, are not possible save to the one who is mistress of the sea, and a battle is necessary to obtain the mastery of the sea.—Compiled from *Moniteur de la Flotte, Royal United Service Institution, Army and Navy Gazette,* etc.

THE ISHERWOOD SYSTEM OF SHIP CONSTRUCTION.—On page 780 of No. 142, mention was made that our collier *Orion* was constructed on the Isherwood system of horizontal framing. This method has not proved the success that its promoters led the shipbuilding trade to believe. As originally planned it saved 8 per cent in structural material. The requirements of the increased scantling found necessary to remedy the structural weakness reduced this saving to nothing. The torsional stresses are so great that one ship built on this system was actually twisted twelve to eighteen inches, and intermediate transverse frames had to be placed. *Shipping,* Illustrated, states that Scott Russell in 1834 originated this system, the first vessels built under it were in 1847 and the 50's. In 1872 J. E. Scott patented a similar construction. Mr. Isherwood later patented the same. It is stated by good authorities that were the classification societies to allow the liberal treatment accorded to the Isherwood system to apply to transversely framed ships, that the latter would be the lighter for the same strength. The cost of labor with transverse framed vessels is less than with the longitudinal or Isherwood framed vessels.

LIFE SAVING APPARATUS AND SALVAGE APPLIANCES FOR SUBMARINE BOATS.—The total loss of all or in most cases of nearly all of the crews in numerous accidents to submarines demands measures for life saving and salvage for the submarines.

The following list shows the casualties among submarines:

1. *Lutin*, French, at Bizerta in 1904, cause technical failure.
2. *Delphin*, Russian, at St. Petersburg in 1904, cause faulty management.
3. *A 1*, English at Nab Lightship in 1904, cause collision when submerged.
4. *Farfadet*, French, at Bizerta in 1905, cause faulty construction and management.
5. *A 8*, English, at Plymouth in 1905, cause bad management.
6. *Kambala*, Russian, in Black Sea in 1909, cause bad management.
7. *C 11*, English, at the mouth of the Humber, cause collision when cruising on surface.
8. *Pluviose*, French, off Cherbourg in 1910, cause collision when submerged.
9. *No. 6*, Japan, 1910, cause, technical failure.
10. *A 3*, English, 1912, cause, collision when submerged.
11. *Vendemaire*, French, 1912, cause, collision when submerged.
12. *B 2*, English, October 5, 1912, collision with S. S. *Amerika* in the early gray dawn.

In the above causes the casualties due to bad management, faulty construction, and technical failures may be overcome readily, but there will always be danger of collisions when submerged. Four of the above casualties were due to collisions when submerged, with two collisions when on the surface.

Life saving apparatus are such means that may be used by the crew of the submarine, while salvage appliances must be used externally to the submarine.

Life saving apparatus are of three different classes:

1. Appliances for saving the lives of all hands.
2. Those that provide for saving the lives of some of the crew.
3. Those that provide for saving the life of individuals.

Pumps and compressed air are appliances of the first kind. Compressed air in steel flasks can be used to expel the water leaked into compartments and thus a submarine having sprung a leak may reach the surface by decreasing its displacement. Detachable safety weights may be detached to decrease the displacement and in like manner permit the submarine to rise to the surface. The French submarine *Loutre* on March, 1911, had such detachable weights that she used successfully. The sudden removal of the weights gave the submarine a sudden impulse to emerge to the surface.

Water-tight bulkheads and cross-bulkheads will insure a degree of safety, but they hamper access to different parts of the boat, and must be kept with water-tight doors closed before collision.

When a submerged submarine is cruising in a condition of equilibrium any sudden increase of weight in either end will cause the boat to assume an approximately perpendicular position—most unfavorable for the boat and crew. In this position the German submarine, *U 3*, was found in the accident January, 1911. The water was shallow.

There are other subordinate appliances for saving all the crew; the best of which is the renewal of the air in the boat so that it may be possible for the crew to remain longer submerged. The supply of oxygen to replace that consumed.

The appliances to provide for saving some of the crew are still of problematical value. It is proposed to have buoyant attachments to the submarine which can be reached by means of water-tight openings by some of the crew who could get out through the door and by detaching the buoyant attachment rise to the surface with it.

This has an advantage of permitting escape from a sunken submarine, but it has many drawbacks. In the first place they would require a number of such detachable buoyant vessels to be attached to the exterior hull of the

submarines and such attachments would interfere seriously with the displacement of the submarine, her speed and ability to dive, and it would then be impossible to have such attachments at places, where (in case of need to abandon a sunken boat) they would be available, since the sunken boat is not apt to lie horizontally on the bottom when sunk, but on its side or inclined.

The French submarine, *Gustave Zédé II*, has a detachable conning-tower. The merits of this fitting are not as yet known.

The third class for saving the life of individuals is common. The principle is to provide each of the crew with a sort of a diving suit. The Germans have adopted the Drager—diving saver. This consisted of a vest with airbag connected with a pair of hose attached as a gag to the mouth of the wearer. The appliance permits the wearer to remain submerged for one hour and upon reaching the surface the breathing apparatus may be easily removed. His arms are free and automobile goggles protect his eyes. This apparatus has been found to be partially satisfactory, but it requires practice to be able to use the diving saver, just as it does for those who are expert divers in diving suits. The protection given by this apparatus is only partial and special training such as is given in England in submarine models is requisite for efficient use of such apparatus.

Means for salvage of sunken submarines consist of lifting docks, wrecking cranes, wreckships, and wrecking lighters. A modern wrecking ship must be able to work under all conditions. She must raise a weight of from 400 to 1000 tons quickly in one hoist from a depth of 50 meters (164 feet). The wrecking vessel should be able to work in a moderate sea and against strong currents and also be able to go to the rescue of the sunken boat promptly, to raise it and transport to a dock. Besides the wrecking vessel should have all the latest equipment for salvage of submarines.

The lifting docks do not meet the first requirement to lift the weight in one hoist except in shallow water. In such a case the sunken boat may be raised to the surface and carried by the dock to shoal water and then lowered again to the bottom and finally raised clear. The use of the lifting dock is thus limited.

Wrecking lighters, built especially for wrecking submarines, must be towed and anchored with accuracy so that they may not be capsized especially with action of a strong current. The need of tugs and other limitations make the docking ship the most desirable.

The German submarine *U 3* was sunk so that her bow pointed up. In this position 28 men were in the bow torpedo room, whence they escaped to the surface. The wrecking vessel could not handle the submarine in such a position and the wrecking crane was used.

The German submarine docking ship *Vulcan*, with double hull and space for lifting a submarine in between the hulls and then docking her in the ship itself, is most satisfactory.

Submarines must have fittings to facilitate salvage. In the first place they should be fitted so that the tackle of a wrecking ship or crane can be attached either by a diver or with special arrangements. The telephone buoy is a most valuable equipment. This can be sent up to the surface from the conning-tower and being connected within the submarine will enable the commander to phone information in regard to the condition in which the sunken submarine may be in special danger.

Many of these features have been adopted in the different navies, though none seem to have as yet provided for all conditions and progress in different navies is very different.

The measures adopted and in use in some navies are doubted by others and progress is being made by all in rendering the management of submarines more reliable and the submerged cruising less dangerous.

The twelve casualties grouped at the head of this article show that in recent accidents submerged collision is the chief danger and efforts to reduce that risk must be chiefly studied and practised.—*Ueberall*, by W. H. B.

BOOK NOTICES.

"Forecasting Weather," by W. N. Shaw, F. R. S., Sc. D., Director of the Meteorological Office, London. Published by the D. Van Nostrand Company. Price $3.50 net.

The work of this distinguished author presents a valuable and interesting volume to the public. As stated in the introduction, he has endeavored to bring the facts of the daily weather into relation with the physical processes of the laboratory, to acquaint the meteorologist with the physicist to the advantage of both.

After a short but useful and necessary chapter on units, the author explains and illustrates the construction and use of synoptic charts, and the method of forecasting by their means. Empirical rules, framed in the light of long experience have been quoted, and the relation of wind velocity to the distribution of pressure, a subject of great importance, has been dealt with. Having set out the position arrived at by empirical generalization, an examination has been made of the physical processes which are developed in the phenomena of weather, and illustrations of the connection between the observed phenomena and the processes upon which they depend are given.

Particularly interesting are the author's chapters upon special departments of the work of forecasting, such as gales, storm warnings, anticyclonic weather, land and sea fogs, night frosts, colliery warnings and forecasts for aeronauts. One chapter is devoted to statistical methods for long-period and seasonal forecasts. The book concludes with a chapter on the practical utility of weather forecasts.

The numerous illustrations are a valuable feature, though the details of the charts have suffered from the process of reduction, the scale of representation being rather minute. As stated by the author, however, no alternative exists except reproduction at full size, which would render the book too cumbersome. These charts are essential to an intelligent perusal of the book, and the defect mentioned above detracts nothing from their usefulness.

The book deals with the methods of forecasting employed by the English Government, and naturally the examples and illustrations analyzed pertain to the British Isles and Western Europe. But the principles studied may be applied to any locality. It is interesting to note that forecasting on a scientific basis was begun in Great Britain about fifty years ago by a naval officer, Admiral Fitz Roy. The rules that had become established, after about twenty-five years experience, were formulated and published by another experienced seaman, the Hon. Ralph Abercromby. The forecasting of the weather and general investigation thereof has and will always be of paramount importance to seamen, in spite of the wonderful advances daily in the construction of ships. Any light thrown upon these subjects is therefore of value to seafaring men. The author rests not here, however,

for valuable hints to agriculturalists, owners or superintendents of collieries and aeronauts are included. Suggestion as to methods of rendering more accurate the forecasts for special localities are given, which, if noted, would probably reduce the percentage of local forecasts which are apparently at variance with the daily reports sent out by our own Weather Bureau. Quite frequently the principle of the general inference is correct, but the caprices of the weather make the local application something quite different from what might fairly have been expected by the forecaster. A well-informed local inhabitant, in possession of the general inferences sent out by the Weather Bureau, could probably give a local forecast more applicable to the particular district than the general official forecast which is all that can reasonably be expected of the Weather Bureau. The reader becomes convinced of the facts set forth above and acquires much more useful information bearing upon this subject, and is well repaid for the time spent thereon. The book should find a place in all libraries.

C. P. SNYDER, Lieut.-Commander, U. S. Navy.

"U. S. Marine Corps Score Book," by Captain William C. Harllee, U. S. Marine Corps. Published by International Printing Company, 236 Chestnut Street, Philadelphia, Pa. 15 cents postpaid.

This book is the summing up of Captain Harllee's wide experience in the instruction of both inexperienced men and of candidates for rifle team.

When on duty at Marine Corps Headquarters Captain Harllee formulated a plan to create an awakening in interest in rifle practice, and under General Elliott put this plan in effect. Its principal features were to give an extended course of instruction to about a hundred selected men and distribute these men to all the stations of the marine corps, and to form camps of instruction with skilful instructors and to gather these men from all accessible stations and put them through a systematic and progressive course designed to instruct them with the greatest economy of time.

When these plans were put into effect the next step was to provide a manual of instruction which would enable men to be prepared at their stations instead of after their arrival at ranges and thus effect a greater economy of time and a larger output of trained riflemen.

His book furnishes the result of his experience along these lines as well as his experience as captain of the Marine Corps Rifle Team for three years.

The text is clear and simple so that men may use it to instruct themselves in case they do not have the benefit of instructors.

The outline for instructors is so presented that unskilled instructors can follow it easily. The first part of the book is for the instruction of inexperienced men and contains no confusing matter not essential for beginners. Then follows the score book proper, then some handy and easily learned rules in regard to the sights, then some notes on external conditions and these are handled with a decision which does not characterize most writers on this subject, then follow notes on methods of instruction and miscellaneous matter.

The book has been adopted as a text for the examination for promotion of marine officers.

It ought to find favor with the navy, naval militiamen and others whose problem, like that of the marines, is to get effective methods with the greatest economy of time.

"Diplomatic Negotiations of American Naval Officers, 1778-1883," by Charles Oscar Paullin. Published by the Johns Hopkins Press, Baltimore. Md., 363 pages. Price $2.00.

To many students of naval history the periods between wars are little known, yet these years of peace are fully as interesting as the wars, and represent much labor and many big achievements on the part of our officers that we are justly proud of. These lectures by Mr. Paullin fill in the gaps between wars and teach us what officers have accomplished as diplomats. Mr. Paullin is one of the leading authorities on American naval history and is well known without introduction to all readers of the Institute. The book is excellently made up, printed in clear legible type.

The easy style of the author makes the reading and study of this work agreeable and very attractive.

Peculiarly interesting are the negotiations with the Barbary States. Korea, the islands of the Pacific, and Africa.

RALPH EARLE

MINUTES OF THE ANNUAL MEETING.

The annual meeting of the United States Naval Institute was held October 11, 1912, at 8 p. m., at the Officers' Mess, U. S. Naval Academy.

Captain J. H. Gibbons, U. S. Navy, presided, there being twenty-two members present.

The first business being the election of officers, the Chairman appointed as tellers: Lieut.-Commander R. C. Bulmer, U. S. Navy, Lieutenant M. Milne, U. S. Navy, and Mr. C. L. Leiper, Instructor, U. S. Naval Academy.

The Chairman announced that the tellers reported as follows:

	Votes.
For President: Rear-Admiral Bradley A. Fiske, U. S. Navy	323
For Board of Control:	
Commander Geo. W. Logan, U. S. Navy	235
Commander H. F. Bryan, U. S. Navy	136
Commander A. B. Hoff, U. S. Navy	131
Commander L. M. Nulton, U. S. Navy	204
Lieut.-Commander N. L. Jones, U. S. Navy	171
Lieutenant E. J. King, U. S. Navy	127
For Secretary and Treasurer:	
Lieut.-Commander Ralph Earle, U. S. Navy	306

Other votes scattered.

The above named officers were then declared elected.

The Secretary and Treasurer reported as follows:

The past year the Institute suffered an irreparable loss in the death on February 23, 1912, of Professor Philip R. Alger, U. S. Navy, who had been its successful secretary and treasurer since February 24, 1903.

The Board of Control in recognition and appreciation of co-members of the Institute for Professor Alger's devotion to the work with which he had been so long and notably associated, requested Rear Admiral Knight to write the article which appeared in the issue of the PROCEEDINGS for March, 1912. Copies of this article together with a suitable letter were transmitted to Mrs.

Alger. Professor Alger's salary was continued to the end of February.

Lieut.-Commander W. B. Wells, U. S. Navy, acted as secretary and treasurer from August, 1911, until November 1911. Professor Alger after November, 1911, was able on account of his health to only attend the meetings of the Board of Control on December 7, 1911, and January 18, 1912.

The present secretary and treasurer was elected by the Board of Control on February 27, 1912.

A firm of public accountants audited the books of the Institute in March, finding them absolutely correct, a real and deserved testimony to the ability and faithfulness of the clerk, Mr. Conroy.

The action taken at the last annual meeting relative to nominating officers for election resulted in the polling of a heavy vote, the highest vote for any member of the Board of Control last year being 72, whereas this year it was 235. Last year the secretary and treasurer received sufficient blank proxies to enable him to re-elect himself, and to select his own Board of Control. This year there are but 37 blank proxies.

The membership of the Institute is now:

Regular	795
Life	129
Associate	142
Honorary	3
Total	1069

During the year 11 members resigned, 15 died, and 109 new members were admitted, making a total increase of 83, against 21 for the preceding twelve months. This is an increase, but still not as great a one as it appears, considering that in 1907 there were 979 members in all. In other words, in five years there has been a net increase of only 90 members.

The quality of material in the PROCEEDINGS cannot be very materially improved if more interest than is evidenced by this record is not taken by the service at large in it. The secretary is, and has been endeavoring to reach every officer in the service, and urge them to become members. The membership from the staff and Marine Corps is not as large as it should be.

Members besides getting shipmates to join are urged to obtain associate members from their friends in civil life who are interested in the service.

The strictures placed by the Navy Department early in March, 1912, upon the material permitted to be published in the PROCEEDINGS, materially reduced the available professional topics and deterred many officers from writing. This action showed itself immediately to the secretary in the fewer articles submitted. On the other hand this procedure is a distinct advantage, because no officer need worry in the slightest on what he submits for publication, as it will not be printed save with the full authority of the Department.

In the endeavor to get mature and authoritative papers on professional subjects reference to the War College was made, and through the co-operation of its president, much valuable matter has been obtained for the PROCEEDINGS. Suggestions for topics of articles suitable or desired by the service are always much welcomed by the secretary.

FINANCIAL STATEMENT FOR THE YEAR ENDING OCTOBER 1, 1912.

Briefly stated, the Institute's financial resources consist of:

a Bonds having a market value of	$42,604.50
(Of this amount $6,753.14 is the Reserve Fund.)	
b Savings deposits to amount of	9,019.62
c A check deposit in Farmers' National Bank of	9,927.52
These result in a total of	$61,551.64
Against which there are liabilities of	5,654.83
Therefore leaving the present actual resources of the Institute	$55,896.81
Without counting the bills receivable which now amount to	7,425.02
Or if they are added the resources become	$63,321.83

Approximately the cost of publishing the PROCEEDINGS per year is $11,000, for which amount there is received from the interest on investments, the dues, the subscriptions and the advertisements, $6000.

The sale of extra publications thus has to make up the deficit. It does this, and leaves a balance for investment.

The excess over expenditures and liabilities for the past year has been $8,431.99. In considering this it must be remembered that this figure for the calendar year of 1911 was but $150, the difference being mostly in the sales of books printed in 1911.

It is to be hoped, as Professor Alger stated in his report of 1907, that at some not so distant date, we may reach the point where the income from our investments will make us independent of any other receipts than the annual dues of members. To accomplish this, our income from investments must be increased from the present $2235 per annum to $7200 per annum. This is being done as funds become available by their investment under the direction of the Board of Control in bonds that are legal trustee security.

The following were then elected life and associate members:

LIFE.

Mr. C. O. Paullin.

ASSOCIATE.

Lieutenant Kemol, Turkish Navy.
Lieutenant L. T. Cutter, U. S. Revenue Cutter Service.
Mr. K. C. Woodward.
Mr. Burnell Poole.
Mr. K. M. Lundburg.
Mr. Elmer A. Sperry.
Mr. Wm. E. Clark.
Lieutenant James Pine, U. S. Revenue Cutter Service.
Lieutenant F. J. Sexton, U. S. Revenue Cutter Service.
Major Wilmot E. Ellis, C. A. C., U. S. Army.
Mr. H. E. Kaighn.
Lieutenant M. Nousret, Turkish Navy.
Lieutenant John F. McGourty, U. S. Revenue Cutter Service.

The following resolution proposed by Lieutenant W. R. Van Auken, U. S. Navy, was adopted:

Resolved, That it is the sense of this meeting that the Institute should allow the members of the Board of Control five dollars for each meeting of the same as may be attended by them, and also that they be furnished one copy of each book, then in print, that is published by the Institute that they may desire.

The following resolution introduced by Commander L. M. Nulton, U. S. Navy, was adopted:

Resolved, That it be the sense of this meeting that the remainder of the salary due the late Professor Alger for the time for which he was elected be paid to his widow, and that the Secretary and Treasurer forward the same with a suitable letter expressing the recognition and appreciation by his co-members of the Institute of his work for, his interest in, and his success with the affairs of the Institute and its publication, the PROCEEDINGS.

Commander A. B. Hoff, U. S. Navy, suggested a change in method of assigning titles for prize essays for the Institute each year. After a discussion of the suggestions by several members, the following resolution was adopted:

Resolved, That it is the sense of this meeting that the Board of Control each year obtain from the summer conference of the Naval War College, the Commander-in-Chiefs of the Atlantic, Pacific and Asiatic fleets, and the Superintendent of the Naval Academy, suggestions as to the most suitable subjects on which the prize essays should be written each year.

There being no further business before the meeting, it adjourned at 8.55 p. m.

RALPH EARLE,
Lieut.-Commander, U. S. Navy,
Secretary and Treasurer.

LIST OF PRIZE ESSAYS.

1879.

Naval Education. Prize Essay, 1879. By Lieut.-Com. A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880.

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881.

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882.

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

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1911.

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NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

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INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut.-Commander T. D. Parker, U. S. N.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1913.

A prize of two hundred dollars, with a gold medal, and a life-membership in the Institute, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1913. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. If, in the opinion of the Board of Control, the best essay presented is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention" or such other distinction as the Board may decide.

5. In case one or more essays receive "Honorable Mention," the writer of the first of them in order of merit will receive seventy-five dollars and a life-membership in the Institute.

6. Any essay not having received honorable mention may be published also, at the discretion of the Board of Control, but only with the consent of the author.

7. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

8. All essays submitted must be either typewritten or copied in a clear and legible hand.

9. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

RALPH EARLE,
Lieut.-Commander, U. S. N., Secretary and Treasurer.

NOTICE.

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now completes its thirty-ninth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute. by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII.

Sec. 1. The Institute shall consist of regular, life, honorary, and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control, and a vote equal to one-half the number of regular and life members, given by proxy or presence, shall be cast, a majority electing.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control, and, if their report be favorable, the Secretary and Treasurer shall make known the result at the next meeting of the Institute, and a vote shall then be taken, a majority of votes cast by members present electing."

The Proceedings are published quarterly and anyone may subscribe for them. The annual subscription is $3.00; single copies, 75 cents. Annual dues for members and associate members, $2.00. Fee for life membership, $30.00.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE TO MEMBERS.

It is believed that the interest and scope of the essays and articles published in the PROCEEDINGS can be continued and improved, and you are cordially invited to assist in this work.

Should any topic occur to you on which you believe an essay or article should be written, or on which you would like to read one, send such topic to the Secretary at once. These topics will be published in the PROCEEDINGS as suggested, desirable ones for essays and articles, and thus many essays and articles on a wide range of subjects may be obtained.

By direction of the Board of Control.

RALPH EARLE,
Lieut.-Commander, U. S. Navy,
Secretary and Treasurer.

NOTICE TO MEMBERS.

More members, both regular and associate, are much desired. Any increase in membership invariably means a larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

RALPH EARLE,
Secretary-Treasurer.

CONSTITUTION, Art. VII, Sec. 8.—"*The annual dues for regular and associate members shall be two dollars, payable upon joining the Institute and upon the* FIRST DAY OF EACH SUCCEEDING JANUARY."

There is no initiation fee.

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Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a (*regular* / *associate*) *member of the U. S. Naval Institute from this date, and forward all publications until further directed to the following address:*

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Respectfully,

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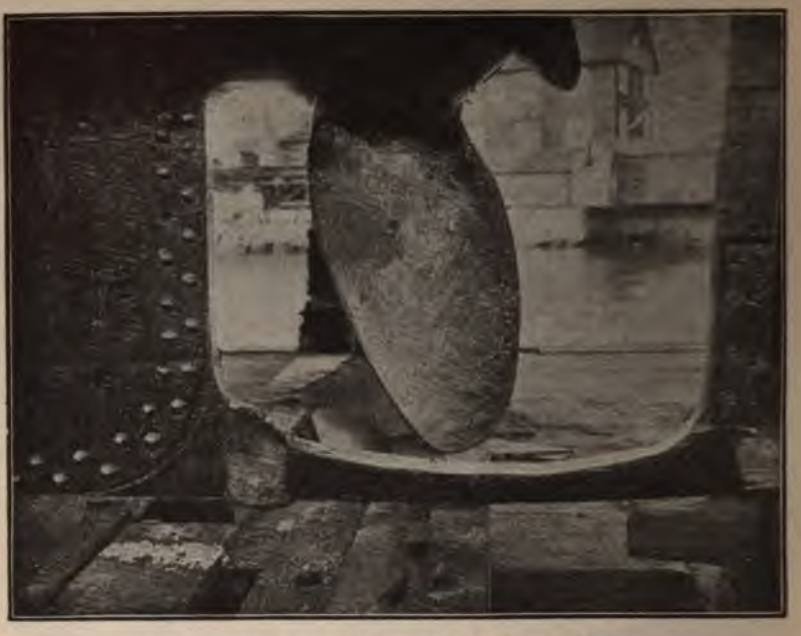

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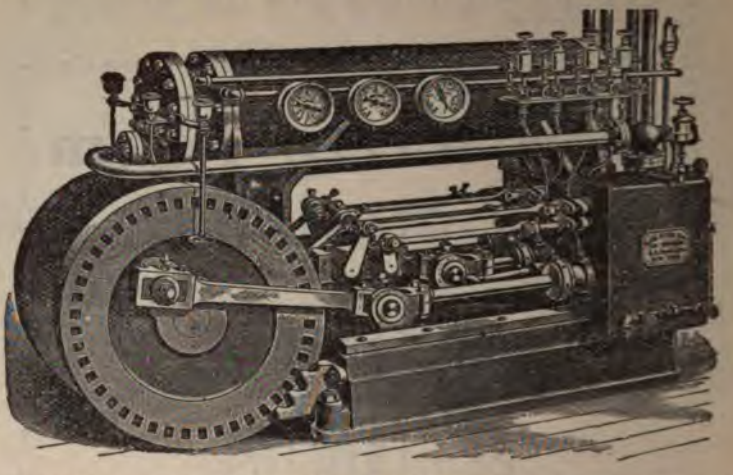

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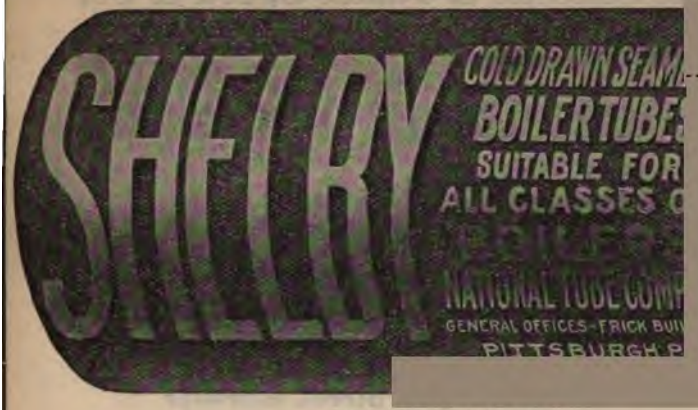

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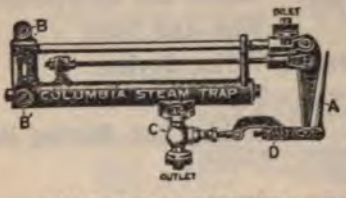

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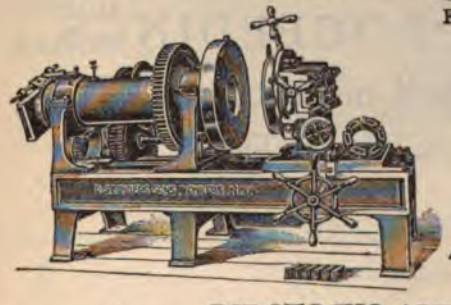

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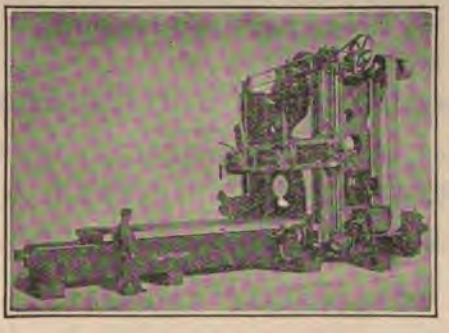

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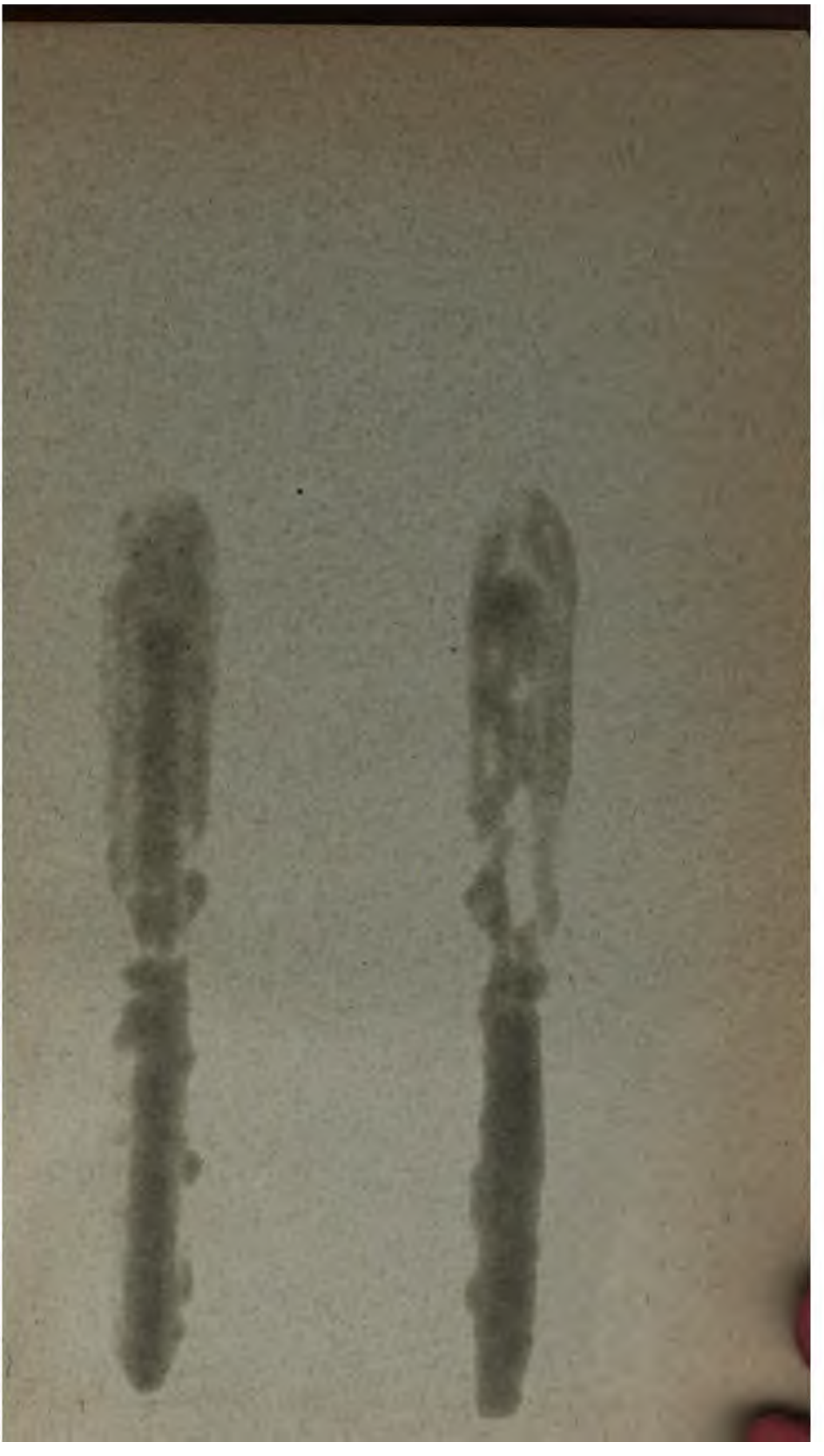

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